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Management Plan for Cougars in Alberta

Wildlife Management Planning Series Number 5

Alberta
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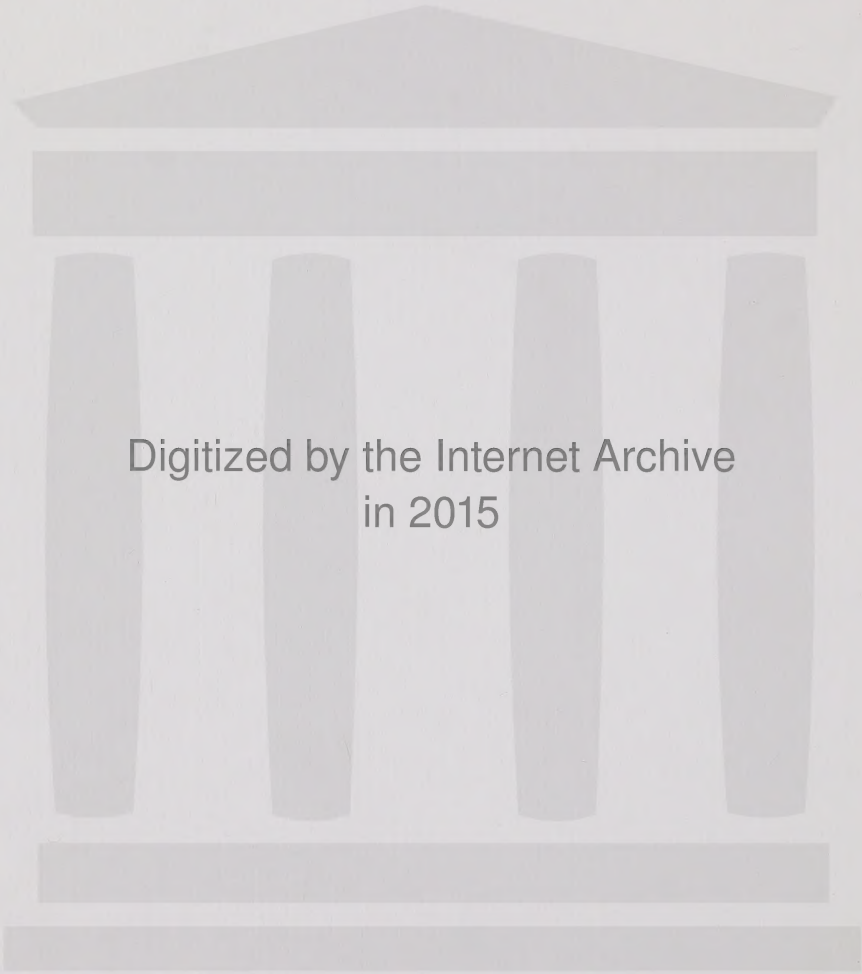
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MANAGEMENT PLAN FOR COUGAR IN ALBERTA

Wildlife Management Planning Series
Number 5

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MANAGEMENT PLAN FOR COUGAR IN ALBERTA
EXECUTIVE SUMMARY

Historical Populations and Management

Although widely distributed in southern and western Alberta during early exploration and settlement, cougar numbers were reduced by the turn of this century. Such scarcity may have been related to the observed decline in large mammal populations, which in turn was related to the unregulated hunting and severe winter weather of that period. Cougar numbers increased during the first half of the 1900s following the recovery of prey populations. Bounty payments between 1937 and 1964 suggest that, in the mountains and foothills north of the Bow River, significant cougar populations occurred, which probably reflected greater ungulate numbers than at the present time.

Current Status

The cougar occupies a similar distribution in Alberta in the 1990s as in historic times. The population in Alberta is estimated at 685 cougars of which about 640 occur on provincial lands (excludes national parks). This estimate is largely based on the results from a single intensive, capture/recapture study in the Sheep River area of southwest Alberta and, therefore, must be considered crude. Density estimates for Wildlife

Management Units range from 4.0 cougar/100 km^2 to <0.1/100 km^2. Numbers of recreational hunting licences sold in Alberta varied from 54 to 173 during 1973-74 to 1989-90 with the peak in 1979. The annual cougar harvest ranged from 21 to 47 animals with a mean of 32. Most (>80 percent) of the harvest was taken in southern Alberta (south of the Bow River). Hunters prefer and select for large, male cougars; however, 45 percent of the harvest during 1973-1988 were females. The provincial cougar population has not been overhunted, but harvests in individual WMUs may have been excessive in certain years. Complaints involving cougars are uncommon in Alberta. Although a mean of 54 occurrences were reported annually to the Fish and Wildlife Division during 1982-1988, only about four claims were approved annually for compensation.

Management Policies, Goals, Objectives and Strategies

1. The cougar population, at 640 on provincial lands, will be maintained in Alberta.
2. Cougar populations will be managed on regional Cougar Management Areas. Maximum allowable annual man-caused mortality in any specific CMA will be 15 percent.
3. Recreational hunting management strategies for cougar will protect regional populations through harvest quotas on a CMA basis, an approximate 48-hour registration requirement, and a maximum annual harvest of 10 percent. The hunting season, open throughout the foothills and mountain region, will be for three months in the winter.

4. Collection of biological data from dead cougars will continue. Mandatory submission of skulls from hunters will replace the existing voluntary program. All cougar mortalities regardless of cause will be registered.
5. The moratorium on pursuit seasons, i.e., special seasons outside of hunting seasons in which houndsmen train dogs or provide viewing opportunities, will be maintained. Should nonconsumptive demand increase, this strategy will be reviewed.
6. The Division will initiate discussions with the appropriate land management agencies and grazing patrons regarding management strategies to minimize cougar-cattle conflicts on public land. In cases of confirmed cougar damage on private land, the Division will attempt to remove the offending cougar, almost always by translocation to another area.
7. Additional studies of cougar populations will be encouraged. One component of study should focus on the effects of predation on prey populations.
8. The Division will provide an extension service to educate residents about cougar in Alberta.

1.0 INTRODUCTION

The cougar (Felis concolor) has always occupied a special place in our world. The species' image as a powerful, silent ghost of the wilderness has been reinforced by our lack of knowledge concerning the big cat. Because it was rarely seen, myths and folklore were a significant source of information for many years. Historically, it was often perceived as a persecutor of big game and livestock (for example, see Alberta Department of Lands and Forests Annual Reports, 1937 and 1938; Young 1946; Calgary Herald, August 30, 1958; Hornocker 1969; Nowak 1976). In recent years, however, this image has softened considerably (Hancock 1980). Alberta's largest member of the cat family is now considered an integral member in the wildlife community of our foothills and mountains.

During 1982-1986, the Alberta Fish and Wildlife Division conducted a radio-telemetry field study of cougars in the Sheep River area (50° 39' N, 114° 38' W), in the foothills and mountains southwest of Calgary. Subsequently, Arc Associated Resource Consultants Ltd. have carried out the study. Most information regarding cougars in Alberta and contained in Section 2.0 of this plan was collected there (see Pall et al. 1988; Ross and Jalkotzy 1989).

This plan is designed to be a blueprint for the future management of cougars in Alberta. Section 2.0 outlines current knowledge of cougar history and biology both in Alberta and in North America generally, and summarizes use of the resource and management efforts to the present day. Section 3.0 recommends goals, objectives, and strategies to ensure the cougar remains an integral part of Alberta's natural environment, and to encourage, at the same time, the wise use of the cougar resource.

2.0 BACKGROUND TO THE PLAN

2.1 Historical Cougar Population

The distribution of cougars in Alberta in historic times included all areas along the foothills and mountains from the 49th Parallel to Grande Prairie, and areas within the South Saskatchewan River drainage to the east (Preble 1908; Young 1946). During the early 1900s, sightings were recorded in the Cypress Hills and other locales east of the more usual haunts in the foothills and mountains (Soper 1964).

Estimates of population levels of the cougar in historic times are based primarily on conjecture. Few people saw them and even fewer hunted them (Soper 1964). Their fur was of no value commercially, so fur traders were not interested in them (Chittenden 1954). However, the meat of a "painter" was considered a delicacy, so some did end up on dinner tables in the Northwest.

In a publication on mammals of Jasper National Park, Soper (1970) mentioned a northward extension of the cougar's range in Alberta during the first half of this century. Based on the lack of mention cougars received in several park reports, he felt that they may have been scarce or absent toward the north of the national parks before that time. Whether this was true toward the east as well is not known. However, native ungulates, which constituted the primary prey populations, were greatly reduced by European settlement and cultivation, market hunting, and severe winter weather at the turn of the century (Cowan 1952; Dwyer 1969; Flook 1962; Stelfox 1964; Stelfox and Taber 1969). For example, elk populations in Alberta at that time numbered just 175-365 animals (Millar 1916). Consequently, cougars

were probably also scarce. As ungulate numbers rebounded during the first half of this century (Cowan 1950, 1952; Dwyer 1969; Lloyd 1927; Stelfox 1964), cougar numbers probably increased as well. In 1933, Game Commissioner, S. H. Clark wrote in his Annual Report to the Dept. of Agriculture that "cougars are increasing in the western part of the Province."

Between 1937, when a bounty was initiated for cougars on provincial land in Alberta, and 1964, when the bounty was removed, records of bountied cougars were reported in Department Annual Reports and provided an additional source of historical information. The Ya Ha Tinda and Nordegg districts recorded the largest numbers of cougars killed for bounty between 1949 and 1962. During the same period, cougars killed for bounty in the Sundre district and all districts to the north outnumbered those killed in the Morley district and all other districts to the south by a ratio of almost 2:1. This distribution of the bounty kill is a reversal of the harvest distribution in recent times. Today, the majority of the hunter kill occurs south of the Bow River while the harvest to the north is very small. It is unknown whether the distribution of the bounty kill reflected the relative abundance of cougars in general, or if other factors such as hunting effort were involved. Possibly there were more cougars in the northern foothills and mountains during the 1950s than there are today because ungulate numbers were greater in that area at that time (e.g., elk, see Gunson 1988).

2.2 Taxonomy, Biology and Requirements of Cougar in Alberta

2.2.1 Taxonomy

The cougar belongs to the order Carnivora and the family Felidae.

Twenty-seven subspecies of Felis concolor have been described throughout its range (Anderson 1983); 15 of these occur in North America. The subspecies found in Alberta is F. c. missoulensis, which also occurs in eastern British Columbia, in Montana, and in northern Idaho. It is the most northerly dwelling subspecies and is among the largest in most physical characteristics (Anderson 1983).

2.2.2 Description

The cougar is the largest wild felid north of Mexico. Throughout its range, only the jaguar (F. onca) is larger. Adult pelage varies very little in colour from tawny to rusty brown with light-coloured underparts and black accents on the face, ears, and tail. Kittens have a brownish buff colour, which is speckled with dark spots that fade with age. Most kittens lose their obvious spotting by the time they are about 6 months old.

All senses are well-developed in the cougar but, for hunting, vision is probably the most important (Seidensticker et al. 1973). The cougar is well-adapted to its existence as a solitary predator of large prey. Adaptations include highly specialized dentition, massive muscles in the jaws and forequarters, and large, sharp claws.

Measurements from 43 cougars (4 subadult and 7 adult males; 10 subadult and 22 adult females) captured in and around the Sheep River study area in southwestern Alberta are summarized in Table 1. Adult males were larger in all body measurements than any other sex-age class. Subadult males were intermediate in size between adult males and adult females, while subadult females were generally smallest. These differences were most evident in cougar weight. Adult males weighed 60 percent more, on average, than adult females.

Table 1. Body measurements of 43 cougars immobilized in and around the Sheep River study area: 1981-1986.

Measurement	Male adult	Male subadult	Female adult	Female subadult
High neck circumference[a]	43(0.80) 7[d]	38(0.87) 4	34(0.49) 21	31(0.26) 10
Low neck circumference[a]	48(0.94) 7	43(1.45) 4	38(0.76) 20	35(0.42) 10
Body length[a]	139(3.56) 7	131(5.24) 4	123(1.03) 22	119(1.47) 10
Tail length[a]	79(1.53) 7	77(1.96) 4	72(1.12) 22	72(1.58) 10
Total length[a]	218(3.42) 7	208(5.39) 4	192(3.35) 22	191(2.18) 10
Chest girth[a]	81(1.23) 7	72(1.87) 4	68(0.58) 22	65(1.06) 10
Shoulder height[a]	75(0.73) 7	70(1.26) 4	66(0.54) 22	63(0.93) 10
R. front foot width[b]	86(2.82) 7	80(2.02) 4	70(1.02) 21	71(1.83) 10
R. front foot length[b]	94(2.31) 7	90(1.89) 4	84(0.93) 21	81(1.78) 10
R. front pad width[b]	63(0.74) 7	59(0.65) 4	54(0.42) 22	53(0.76) 10
R. foot pad length[b]	50(0.36) 7	47(1.22) 4	43(0.61) 22	42(0.90) 10
R. hind foot width[b]	73(2.31) 7	70(2.43) 4	62(1.20) 21	65(2.15) 10
R. hind foot length[b]	95(0.69) 7	91(2.29) 4	86(0.82) 21	82(1.33) 10
R. hind pad width[b]	53(0.97) 6	51(1.32) 4	45(0.41) 22	44(0.92) 10
R. hind pad length[b]	47(0.80) 7	46(1.04) 4	40(0.41) 22	39(0.69) 10
Head circumference[a]	52(1.00) 7	47(1.71) 4	43(0.41) 22	41(0.53) 10
Head length[a]	28(1.33) 6	26(0.58) 3	24(0.14) 20	23(0.25) 10
Head width[a]	16(0.29) 6	15(0.54) 4	14(0.10) 22	14(0.12) 10
Upper canine width at tip[b]	48(1.03) 5	47(1.60) 4	41(0.47) 19	41(0.66) 10
Upper canine width at base[b]	60(0.00) 3	59(2.85) 3	51(0.44) 18	51(0.43) 10
Lower canine width at tip[b]	41(0.56) 6	41(1.25) 4	35(0.39) 20	35(0.75) 10
Weight[c]	72(1.14) 6	53(3.67) 4	45(0.96) 22	40(1.55) 10

[a]measurements in centimetres.
[b]measurements in millimetres.
[c]measurements in kilograms.
[d]format: mean (mean SE) sample size.

Average weights of cougars from the Sheep River area appear to be greater than those reported elsewhere for F. c. missoulensis. Anderson (1983), in his critical review of the cougar literature, calculated mean weights for F. c. missoulensis based on intact carcasses or immobilized "adult" or "mature" cougars believed to be at least 24 months old. The mean weight of 75 males was 57 kg. In the Sheep River area, the mean weight of male cougars over 2 years of age (i.e., adult cougars over 2.5 years old and subadults not less than 24 months) was 67 kg (n=8). Mean adult female weight in Anderson's sample was 42 kg, slightly less than the mean weight of females over 24 months (44 kg) in the Sheep River area. The mean weights of cougars in the Sheep River area may appear higher because the sample does not include subadults whose ages were not known. If these latter cougars were included, the mean weights would have been lower.

2.2.3 Distribution

Cougar populations occur in mountain and foothill habitats of the Rocky Mountains in southwestern Alberta (Figure 1). Occasional sightings or cougar kills have occurred in the Cypress Hills, and in the Milk River and the South Saskatchewan River drainages east of the mountains in recent years (Nowak 1976). Kuyt (1971) reported a possible sighting in Wood Buffalo National Park close to the northern boundary of Alberta.

The Animal Incidence Reporting System (AIRS) provides additional information, regarding the distribution of cougars in Alberta since 1982. The nature of the AIRS reporting system does not allow the differentiation of authentic observations from less reliable ones. However, the data probably do provide a general indication of the presence of cougars outside of their regularly occupied range in the foothills and mountains.

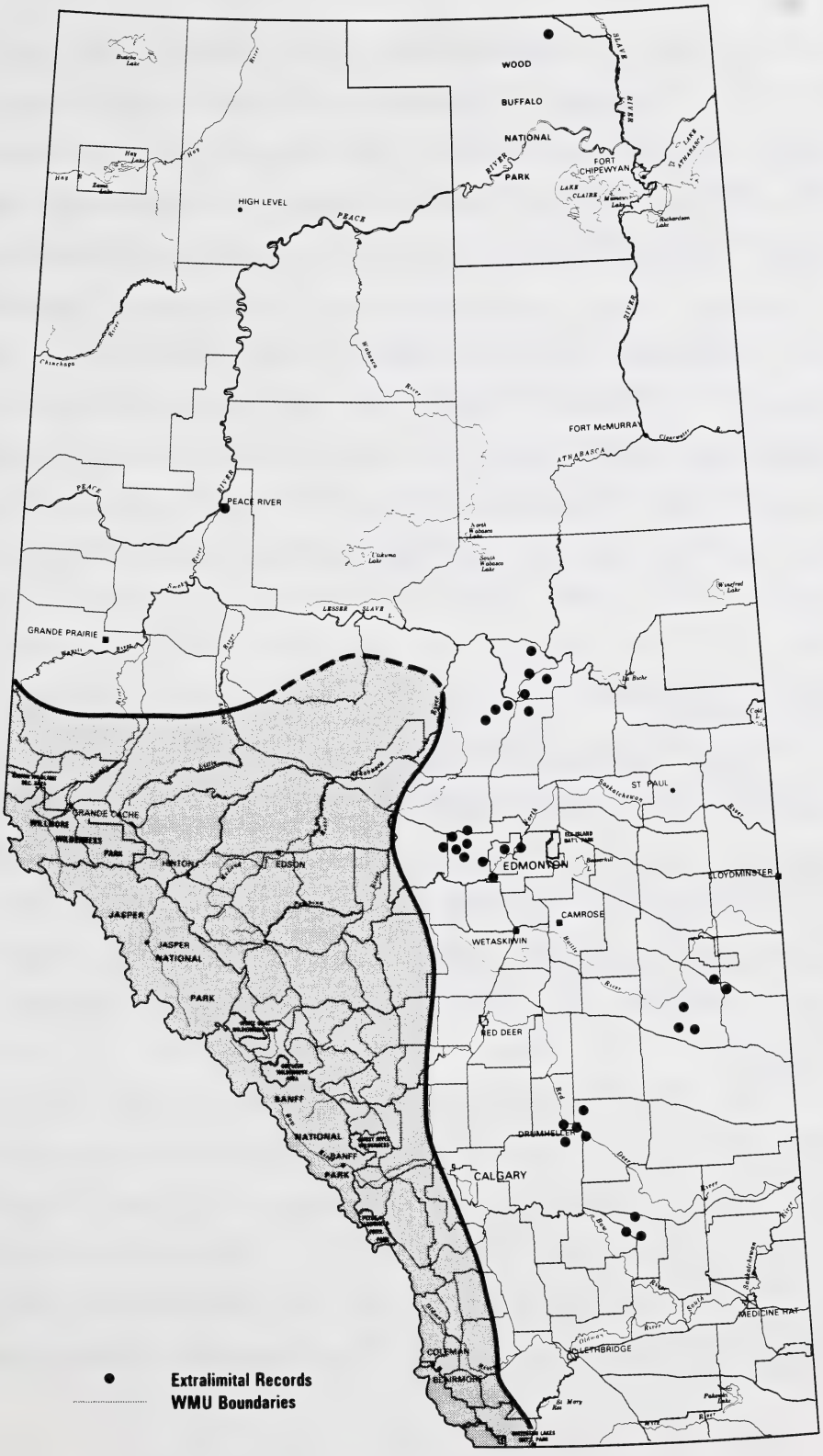


Figure 1. Approximate distribution of cougar in Alberta in 1988 (in part, from AIRS occurrences), with some extralimital observations during 1982-1988.

Extralimital sightings of cougars most frequently occur in the vicinity of settlements located in major river valleys. These valleys probably serve as travel corridors for transient cougars since river valleys typically have more cover than the surrounding land and they often have greater numbers of ungulates. Cougars have been sighted almost annually in the vicinity of Fort Assiniboine on the Athabasca River, Edmonton on the North Saskatchewan River, and Drumheller on the Red Deer River. Additional sightings are scattered throughout the aspen parkland and prairies east of Edmonton and Calgary between St. Paul and the United States border. The northerly limit of occurrences since 1982 has been in the vicinity of Lac La Biche and Cold Lake in the east and Peace River and the Clear Hills, to the west.

2.2.4 Habitat

Cougar habitats in Alberta encompass a wide range of ecological conditions. The following description of those habitats is summarized from Ecoregions of Alberta (Strong and Leggat 1981). South of the Bow River, cougars are found in the Alpine, Subalpine, Montane, Boreal Foothills, and Aspen Parkland ecoregions. In addition to these ecoregions, cougar habitats north of the Bow River also include portions of the Boreal Uplands Ecoregion.

Vegetation and topography in cougar habitats are quite variable. Subalpine forests of Engelmann spruce, lodgepole pine, and alpine fir are found from the 49th Parallel to the northern limit of the cougar's range. Montane forests of white spruce, poplar, and lodgepole pine occur in the Athabasca, North Saskatchewan, Bow, and the Crowsnest river valleys. These montane forests are also found south of the Bow River in the Porcupine Hills

and in the foothills east of the Livingstone Range. The uniform lodgepole pine forests of the Boreal Foothills Ecoregion are found in cougar range only north of the Bow River, while the aspen/grassland mosaic of the Aspen Parkland Ecoregion occurs in cougar range only south of the Bow River. Topographic relief is greatest in the subalpine forests and least in the boreal uplands.

Mean winter temperatures in these ecoregions range between -7.5°C and -12.5°C and mean maximum snow accumulations are between 30 cm and 155 cm. Duration of snow cover is also variable at between 120 and 155 days. Depth and duration of snow cover increase with increasing elevation and latitude, while average winter temperatures decline along the same gradients. Snow depths are greatest and winter temperatures are lowest in the Alpine and Subalpine ecoregions in northern portions of the cougar's range in Alberta. Warm chinook winds are most frequent along the major river valleys where they result in very low snow accumulations on south- and west-facing slopes. Chinooks occur least often in the Boreal Upland Ecoregion.

In addition, the distribution of ungulates differs between northern and southern portions of the cougar's range in Alberta. Both white-tailed deer (Odocoileus virginianus) and mule deer (O. hemionus) are found throughout the cougar's range. However, better deer habitat, milder winters, and lesser snow accumulations result in higher deer densities in the south (Alberta Fish and Wildlife Division 1987). Elk (Cervus elaphus) are also found in higher densities in the south since quality elk habitat is more plentiful there than to the north (Gunson 1988). In the north, elk populations are more localized, primarily along major river valleys. Moose (Alces alces) densities in the north are higher than average densities in

the south (Lynch 1973). Wolves (Canis lupus) are scarce in southern areas, while to the north they are more common (Alberta Fish and Wildlife 1991).

2.2.5 Social Organization

2.2.5.1 Social Structure

Cougars are almost exclusively solitary except while breeding and while kittens or juveniles are dependent on their mother (Seidensticker et al. 1973). Although not strongly territorial, cougars defend a home range (Hornocker 1970; Seidensticker et al. 1973). Spatial overlap across home ranges of adult females may be considerable, although temporal separation is maintained by occupants that tend to avoid each other. Home ranges of male cougars overlap less, but usually will encompass those of several females.

2.2.5.2 Home Ranges in the Sheep River Area

Home Range Size - Average home range sizes of radio-collared adult male and female cougars in the Sheep River area between 1982 and 1986 are listed in Table 2. The average adult male home range of 365 km^2 primarily represents the use of space by one adult male tracked for three consecutive years. The other male, tracked continuously for one year, used an area which was about 40 percent smaller. The largest home range of any radio-collared cougar in the Sheep River study, 1031 km^2, was recorded for an adult male tracked for only nine months. However, radio locations within the perimeter of that area indicate that he regularly used an area that was considerably smaller. When the five outermost radio locations are ignored (14 percent of 36), his home range was only 368 km^2.

The sizes of home ranges of adult females, irrespective of reproductive status, were not significantly different in winter compared with those ranges occupied in summer.

Table 2. Home range size[a] of radio-collared adult resident cougars in the Sheep River study area between 1982 and 1986.

Cougar Sex	Size of Home Range		
	Winter[b]	Summer[c]	Annual
Female[d]	106 (56-227) n=22	98 (31-239) n=20	158 (89-318) n=14
Male	210 (87-304) n=5	351 (178-908) n=7	365 (232-438) n=4

[a]all radio telemetry locations were digitized and mapped using a UNIX mainframe computer, areas were calculated from the digitized data utilizing a program called AREA; the program uses the minimum area convex polygon method to measure area in km^2.

[b]November to April.

[c]May to October.

[d]irrespective of reproductive status.

While accompanied by kittens (up to 6 months old), a female's home range averaged 73 km^2. When a female had dependent juveniles (7 months - independence) travelling with her, average home range increased to 148 km^2. This average is significantly greater than the average size of female home ranges when females were travelling alone (116 km^2). Increased energy demands of larger, more mobile juveniles may necessitate home ranges larger than those required by lone adult females.

Home Range Shifts - Home range boundaries of resident adults were relatively stable during the Sheep River study. Annual home range boundaries, for those cougars in this age-group that were radio-collared for two or more consecutive years, tended to overlap considerably from year to year and from season to season.

2.2.5.3 Home Ranges in Other Studies

The size of cougar home ranges reported in the literature varies widely (Table 3). Different ecological conditions result in large differences in home range size and land use by cougars in different areas. In many studies, cougars had distinct summer and winter home ranges that, in some cases, were not contiguous (Ashman et al. 1983; Hemker 1982; Seidensticker et al. 1973). Annual home ranges in these discontinuous areas tended to be larger than in areas where seasonal shifts did not occur.

2.2.6 Population Dynamics

2.2.6.1 Natality

Breeding, pregnancy, parturition, and postnatal care may occur at any time throughout the year. In the Sheep River study area, most births occurred during the spring and summer. Ten of 24 litters (42 percent) were born during August.

Table 3. Annual home range sizes for adult resident cougars in North American studies.

Location	Average annual home range size (km^2) Male	Female	Source
Alberta	365 n=4	158 n=14	Pall et al. (1988)
Utah	826 n=1	685 n=4	Hemker et al. (1984)
Idaho	453 n=1	268 n=4	Seidensticker et al. (1973)
California	152 n=4	66 n=2	Kutilek et al. (1980)
British Columbia	151 n=2	55 n=6	Spreadbury (1988)

In other published studies, 55 percent of all birth records occurred in April, June, July and August (Anderson 1983). However, in Utah and Wyoming, 18 of 20 litters detected in and around the study areas were born between August and December (Hemker et al. 1984; Logan et al. 1986). Birth peaks could evolve if there were distinct advantages to giving birth in particular seasons of the year. In northern latitudes, cold winter weather could increase mortality of very young kittens. This would explain why there appears to be a greater probability that kittens are born during the spring, summer, and fall, than in midwinter.

In the Sheep River area, the average number of young, at 4 to 6 months of age, was 2.2, based on 22 litters. The sex ratio was 1.4 females for every male kitten (n=48 kittens), not significantly different from 1:1. Litter sizes of 2 and 3 were most common in an extensive survey of the literature (Anderson 1983). When all sources of reproductive information were considered, Anderson (1983) reported average litter sizes of 2.3 to 3.0 at birth (n=43) and 2.6 to 2.8 when litter sizes were determined at some time after birth (n=280). Litter sizes when young are 4 to 6 months old may be smaller in Alberta than in the United States, if the more rigorous winters in Alberta lead to increased mortality among young kittens.

The age when female cougars first produced young in the Sheep River area ranged from 29 months to 48 months (n=6). Since the gestation period for cougars is about 92 days (Anderson 1983), these cougars probably bred when they were between 26 and 45 months old. The frequency of monitoring in the Sheep River area was insufficient to detect litters which were born and lost early. First breeding at 45 months may represent a case where the first litter was lost. Sizes of first litters at 4 to 6 months of age were 3, 3, 2, 2, 1, and 1, for a mean of 2.0, which is very similar to

the overall mean litter size.

Documented ages at first breeding of captive cougars range from 22 to 33 months (n=9; Eaton and Velander 1977; Rabb 1959; Young 1946). Hornocker (1976) contended that a wild female would not breed until she established residency in an area; however, Hornocker's study population was not heavily hunted. In an exploited population, he suggested that females probably breed as soon as they are biologically capable, since usually there are vacant areas in which to settle. In Nevada, the average age when nine females gave birth for the first time was 32 months (Ashman et al. 1983). In Wyoming, the youngest reproducing females were 3 to 4 years old (Logan et al. 1986).

The mean reproductive interval--the time between successive births--was 19 months for six females which successfully raised consecutive litters during the Sheep River study (range: 12 to 25 months). Another female gave birth to her second litter 12 months after her first was born. However, the fate of the first litter of three kittens was not documented past 7 months of age. Since ground monitoring of radio-collared females during the summer months was not conducted, litters that were lost soon after birth during the summer would not have been detected.

Ashman et al. (1983) found the average reproductive cycle was 17.4 months (range 11.5 to 24) in a sample of 12 adult females in Nevada. In Utah, one radio-collared female had consecutive litters 24 months apart (Hemker et al. 1984). Two females in Wyoming had birth intervals of 13 and 19 months (Logan et al. 1986). In Idaho, three of four adult females produced offspring at 24 month intervals; the fourth female produced three litters in just over five years (Hornocker 1970).

2.2.6.2 Dispersal

In the Sheep River study, 11 of 22 kittens that became independent between 1982 and 1986 dispersed (i.e., left their maternal home ranges and did not return). Dispersal from the maternal home range did not necessarily occur immediately after independence. Independent juveniles stayed in the vicinity of their maternal home range for up to eight months. However, seven juveniles left the area within two months. The age at which these dispersals occurred varied from 10 to 22 months; the mean dispersal age was 16 months.

Dispersal of juvenile and subadult cougars from their maternal home ranges typically occurred in April, May and June; 8 of 11 cougars left during those three months. Cougar dispersal during the fall and early winter was not observed. Dispersal in spring and early summer may occur more often because there is an increase in the availability of small prey and travelling is not impeded by snow. During the winter, a recently independent young cougar may tend to remain in its maternal home range because the signs of its mother's presence are more obvious.

The fates of 8 of 11 cougars that dispersed from their maternal home ranges were recorded. Five of the eight were shot between 25 km and 150 km from their maternal home ranges. Two, a male and a female, were shot as subadults, while the other three, two females and one male, reached adult status. They were 2 years 8 months, 3 years 5 months, and 5 years 6 months of age, respectively, when they were shot. Two females that dispersed from their maternal home range died of natural causes as subadults. Dispersal was documented for one cougar, which subsequently established a home range 55 km north-northwest of her mother's home range.

Eight radio-collared female cougars did not disperse. Instead, at

the end of 1986, they appeared to be establishing home ranges contiguous with their maternal home ranges. In autumn 1987, all eight had established residency in the areas in which they had been travelling in spring 1986. In one case, the adult female died and one of the female's kittens established residency in her mother's former home range.

In all previous studies, dispersal from the maternal home range and the study area was typical. All 12 young in the Utah study dispersed from their maternal home ranges (Hemker et al. 1984). Two turned up as hunter kills in the following two years, 118 km and 120 km from their maternal home ranges. In addition, a subadult, ear-tagged as a kitten in the Utah study area, was shot 35 km from her maternal home range. Average dispersal distances for 8 male and 11 female subadults in the Nevada study were 50 km and 29 km, respectively (Ashman et al. 1983). Maximum dispersal distances recorded for the two sexes in the same study were 112 km and 64 km, respectively. Hornocker (1970) and Seidensticker et al. (1973) recorded dispersals of up to 160 km from their Idaho study area. Logan et al. (1986) reported a juvenile male that was recaptured 274 km from his natal area.

Two records of juveniles and subadults not dispersing from their maternal home ranges were found in the literature. Logan et al. (1986) mentioned a 3-4 year old female that was shot only 9 km from her natal area. Ashman et al. (1983) documented a female that established a home range immediately adjacent to her mother's.

2.2.6.3 Mortality

During 1982-1988, deaths of 22 radio-collared cougars captured at Sheep River were reported from all locations within and outside of the study area (Table 4). The adult age class sustained the largest losses: five

males and eight females. Sport hunting was the most common, known cause of death. Three adult and three subadult males, and five adult and two subadult females were legally shot during hunting seasons. Another adult male was shot illegally before the opening of the season. Adult male cougars accounted for the deaths of three other cougars: one adult male, and one subadult and one juvenile female. Pyothorax, caused by a heavy infection of Streptococcus canis, caused the death of one subadult female. Another subadult female died of a broken back, an injury she sustained while attacking a mule deer. Three adult females died of unknown causes.

Mortality in or near the Sheep River study area between 1984 and 1988 was documented for 12 cougars, including 10 that were radio-collared or ear-tagged. During 1984, three males were legally harvested by hunters. In 1985, the only mortality recorded was an adult female who was also shot legally during the January hunting season. Three independent subadult females died from natural causes in 1986. In 1988, five cougars died. Legal hunting accounted for one adult and one subadult male, and one adult and one subadult female. A second subadult female was accidentally snared. Known annual mortality was approximately 11-14, 3, 9-10 and 14 percent of the total population during 1984, 1985, 1986 and 1988, respectively. Mortality of kittens younger than 4 to 6 months of age was not determined. In addition, natural mortality in the study area could not be detected for cougars that were not radio-collared.

2.2.6.4 Recruitment

The annual recruitment rate may be defined as the number of surviving offspring produced per adult female during a 12-month period (McCullough 1984). Recruitment rates are normally determined when young

Table 4. Mortality between 1981 and 1988 of cougars marked near Sheep River, Alberta.

Cause	Males		Females			Total
	adult	subadult	adult	subadult	juvenile	
Legal hunt	3	3	5	2		13 (59%)
Illegal kill	1					1 (5%)
Male cougar	1			1	1	3 (14%)
Accidental				1		1 (5%)
Disease				1		1 (5%)
Unknown			3			3 (14%)
Total	5 (23%)	3 (14%)	8 (36%)	5 (23%)	1 (5%)	22

cougar reach an age where they become important to the population, such as when they reach sexual maturity. Recruitment rates in the Sheep River area were determined for when cougars became 2.5 years of age and were considered adults. This age coincides with the estimated age of first breeding for female cougars. Mortality of cougar kittens younger than 4 to 6 months of age could not be documented in the study area, because most litters were not seen until they were that age. However, between 4 to 6 months of age and independence, mortality was very low.

Nine litters raised in and around the study area were radio-tracked through to adulthood. The nine litters totalling 21 kittens were born to seven adult females. By independence, the number of kittens had been reduced by 1 to 20. Another six died before they reached 2.5 years of age. Eleven were known to be alive at the latter age, while fates of the remaining three were unknown. The annual recruitment rate can be calculated as follows:

$$\text{Annual recruitment rate} = \frac{\frac{11 \text{ to } 14 \text{ kittens}}{7 \text{ females}}}{18.5 \frac{\text{months}}{\text{female}}} \times 12 \frac{\text{months}}{\text{year}}$$

$$= 1.0 \text{ to } 1.30 \frac{\text{kittens}}{\text{adult female}}$$

where: kittens = no. of kittens surviving to adulthood.

females = no. of adult females which produced the surviving kittens.

$18.5 \frac{\text{months}}{\text{female}}$ = average reproductive interval

2.2.6.5 Population Structure

In the Sheep River population, resident adults constituted 43 to 61 percent of the total cougar population between 1983 and 1988. The average proportion of adults in the population was about 45 percent. Adult males were always outnumbered by adult females; the ratio during 1985-1988 was about 1 male to 2.5 females.

The number of independent subadults and juveniles detected each year was quite variable. They made up between 5 and 30 percent of the study area population. Transient adults greater than 4 years old, (i.e., mature adults that did not show affinity for an area), were not detected. All radio-collared cougars that were monitored during their transition from subadults to adults settled into areas in which they could be predictably located over more than six months. In the Sheep River area, it appeared that the transient phase of a cougar's life cycle occurred almost entirely while it was a subadult (1.6 - 2.5 years), as was the case in other studies (e.g., Seidensticker 1973). However, older transients have been detected in intensive studies of cougars elsewhere (Seidensticker 1973; Spreadbury 1988). The lack of older transients in the Sheep River area may be related to hunting pressure throughout the Eastern Slopes of Alberta. A heavily hunted cougar population in which resident turnover was frequent would have fewer old transients since home ranges would be left vacant more frequently. A cougar population that was hunted lightly would have little turnover in the resident population and a higher number of old transients could result.

Dependent kittens and juveniles constituted between 22 and 51 percent of the total cougar population in the study area each winter.

The sex ratio of cougar populations has been reported in Idaho (Hornocker 1970; Seidensticker et al. 1973), Utah (Hemker et al. 1984),

Colorado (Currier et al. 1977), New Mexico (Bavin 1976, 1978; Donaldson 1975), Nevada (Ashman et al. 1983) and Wyoming (Logan et al. 1986). In all of these intensive studies, adult females outnumbered adult males. Only the Utah study area was not subjected to any hunting pressure during the study. However, the latter area had been hunted before that study began. Hunting pressure in the other study areas varied from light to heavy.

The age structure of populations in Nevada, New Mexico, Idaho and Colorado were analyzed by Anderson (1983), while Logan et al. (1986) reported on the age structure of a cougar population in Wyoming. In Nevada, Colorado and New Mexico, between 56 and 75 percent of the total population was adult (24+ months). In Idaho, adults (24+ months) made up about 60 percent of the total population over a period of eight years. In Wyoming, the 24+ month class constituted about 44 and 58 percent of the total population during two years of study (Logan et al. 1986).

2.2.6.6 Density

Densities of between 2.7 and 5.9 cougar/100 km^2 were determined for the total cougar population in the 780 km^2 of the Sheep River study area between 1984 and 1991 (Table 5). A second density estimate for this period was calculated from composite home ranges for all resident adult females during the winter of the population estimate. Since composite home ranges of adult females tended to extend beyond the study area boundary, densities were lower when based on the total area the ranges encompass. The total population densities including dependent kittens and juveniles based on these composite home ranges varied between 2.1 and 3.3 cougar/100 km^2. Average density for the same study area during 1988-1990 was 4.9 cougar/100 km^2 [range 4.6 (1988) to 5.8 (1990)] (Ross and Jalkotzy 1990).

Table 5. Cougar densities[a] in the Sheep River area during winters between 1984 and 1991.

Area	Resident adults	All independent cougars[b]	Total Population[c]
Study area			
1984	1.5 - 1.7	1.9 - 2.4	2.7 - 3.3
1985	1.7 - 1.8	2.8 - 3.1	3.8 - 4.1
1986	1.8	2.6	3.8 - 4.1
1988	2.2	2.4	4.5 - 4.7
1989	2.1	2.9	4.2
1990	2.2 - 2.3	2.6 - 2.8	5.8 - 5.9
1991	1.9 - 2.1	3.1 - 3.2	5.3 - 5.4
Composite - female home range			
1984[e]	1.2 - 1.3	1.5 - 1.8	2.0 - 2.5
1985[f]	1.1	1.8 - 1.9	2.4 - 2.6
1986[g]	1.4	2.0	3.1 - 3.3

[a] cougar densities in cougars/100 km^2.
[b] includes resident adults and independent subadults and juveniles.
[c] includes dependent juveniles and kittens.
[d] study area = 780 km^2, the study area perimeter was digitized and mapped using a UNIX mainframe computer, area was calculated from the digitized data utilizing a program called AREA; the program uses the minimum area convex polygon method to measure area in km^2.
[e] composite female home ranges 1983-84 = 1034 km^2.
[f] composite female home ranges 1984-85 = 1233 km^2.
[g] composite female home ranges 1985-86 = 976 km^2.

Cougar densities within the Sheep River study area were similar to those determined for many areas of the western United States, where intensive studies have been conducted (Table 6). Densities varied from 0.3 cougar/100 km^2 on annual home ranges to 7.4 cougar/100 km^2 on winter ranges where ungulate movements were restricted by heavy snow. In the East Kootenays of British Columbia, density estimates of between 3.5 and 3.7 cougars/100 km^2 were determined during an intensive capture-recapture and radio telemetry study in 1986 and 1987 (Spreadbury 1988). The large variation in reported densities is, at least in part, a reflection of the many different habitat types that cougars will inhabit. Low prey abundance and vulnerability may keep cougar numbers at low densities (Hemker et al. 1984). At higher prey densities, other factors such as the cougar's social behavior may limit their population density (Seidensticker et al. 1973).

2.2.7 Predation

2.2.7.1 Food Habits

Cougar food habits in the Sheep River area during winters, 1982-89 were studied by locating kills made by radio-collared cougars, and by analyzing cougar scats. In addition, stomach contents were examined from cougars shot by hunters in Alberta.

Cervids are the most common prey item for cougars in Alberta (Table 7). Overall, the deer family contributed 73 percent of all prey occurrences. They were most prevalent in the cougar kill sample, representing over 80 percent of all kills found. Of the cervids, deer were the most frequent contributors to the cougar's diet. They constituted 38 percent of the overall prey sample. When they could be differentiated, mule deer outnumbered white-tailed deer almost 12:1. Moose (23 percent) and elk

Table 6. Cougar population densities reported in intensive studies in North America.

Location	Estimated density[a] (cougar/100 km^2)		Source
	annual	winter	
Alberta	2.7 - 5.8		Ross and Jalkotzy (1990)
Utah	0.3 - 0.5	0.6	Hemker et al. (1984)
Idaho		2.1 - 7.4	Seidensticker et al. (1973)
California	3.5 - 4.4 1.5 - 3.3		Sitton (1976, 1977); Kutilek et al. (1980)
Colorado		1.7 - 3.3	Currier et al. (1977)
Arizona	3.2 - 3.5		Shaw (1977, 1979)
Nevada	1.4 - 1.6		Ashman (1976); Ashman et al. (1983)

[a]calculated by dividing the size of study area by the total number of cougars (including dependent kittens and juveniles) present.

Table 7. Prey killed and biomass consumed by cougars during winter in and around the Sheep River area, Alberta: 1981 to 1989.

Prey	Number of prey killed and biomass consumed[a] by:											
	Female cougars				Male cougars				All cougars			
	No.	(%)	Biomass	(%)	No.	(%)	Biomass	(%)	No.	(%)	Biomass	(%)
Moose	6	8	711	15	17	68	2015	84	25	23	2963	40
Elk[b]	14	19	1799	39	2	8	257	11	17	16	2155	29
Deer	39	53	1833	40	2	8	94	4	42	39	1974	27
Bighorn sheep	3	4	165	4	0	0	0	0	3	3	165	2
Porcupine	6	8	30	<1	1	4	5	<1	8	7	30	<1
Cougar	0	0	0	0	1	4	17	1	1	1	17	<1
Other[c]	6	8	50	1	2	8	11	<1	12	11	82	1
Total	74		4590		25		2399		108		7386	

[a]biomass consumed assumes the following live weights: moose calf 150 kg, elk cow 200 kg, elk calf 125 kg, deer 60 kg, bighorn sheep 70 kg, cougar 20 kg, beaver 12 kg, coyote 12 kg, dog 12 kg, porcupine 6 kg, snowshoe hare 1.5 kg, and spruce grouse 1 kg. Estimated prey biomass consumed was determined by applying a utilization factor of 0.79 for all ungulates and 0.85 for smaller prey items to the live weights.

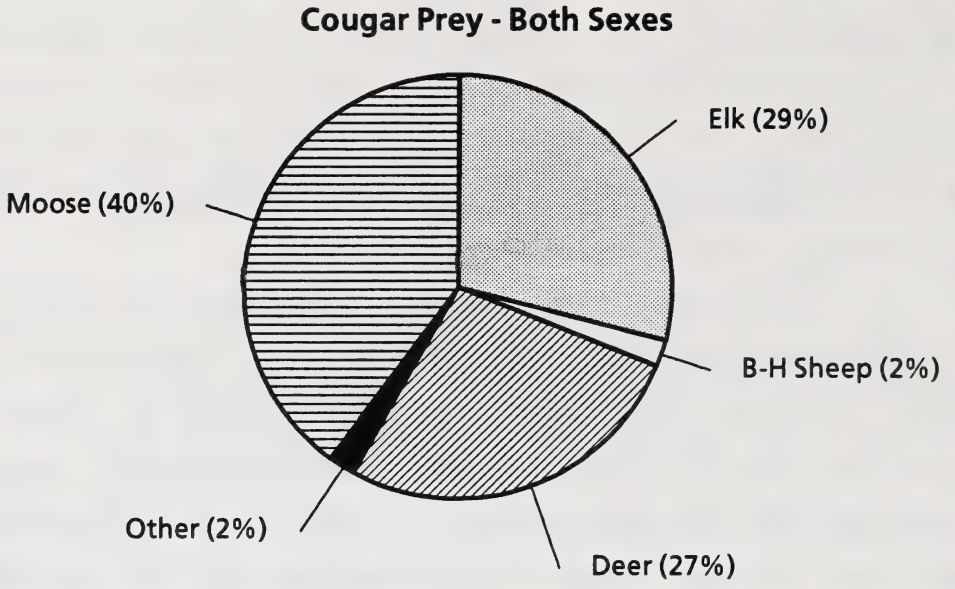
[b]elk killed were assumed to be 50 percent calves and 50 percent adults (see Pall et al. 1988).

[c]includes coyote, dog, beaver, snowshoe hare, and spruce grouse.

(16 percent) also made important contributions to the cougar's winter diet. Moose calves and young female elk were the most preyed upon components of their populations in the study area. Deer from all age groups were killed. Porcupine (Erethizon dorsatum) and beaver (Castor canadensis) were the only non-cervid prey items that were encountered regularly.

If the biomass of prey consumed is estimated from the kill data collected in the Sheep River area, the importance is emphasized for moose calves in the diets of resident cougars (Table 7, Figure 2). Since moose calves are more than twice the weight of the average deer, moose were determined to be of greater importance to cougars, in terms of biomass, than were deer. Similarly because of their large body size, elk contributed a greater amount to the diet of cougars than did deer. The contributions of beaver and porcupine to a cougar's winter diet were very small, because of their small body sizes.

The prey items found in the winter diets of cougars in Alberta are similar to those found elsewhere (Ackerman 1982; Anderson 1983). Most studies indicated that deer were the most important prey item, usually representing over half of prey occurrences, followed by some combination of domestic stock. One exception occurred in the East Kootenays of British Columbia where elk were of much greater importance than deer to cougars (Spreadbury 1988). The major difference between the diet of cougars in Alberta and that of cougars studied elsewhere in North America is the relative frequency of different cervid species in the diet. Reports of cougars killing moose were very few (Spalding and Lesowski 1971), while deer and elk usually contributed a greater amount to the total. This may be a reflection of the relative population levels of these cervids in the areas where previous food habits studies were conducted.



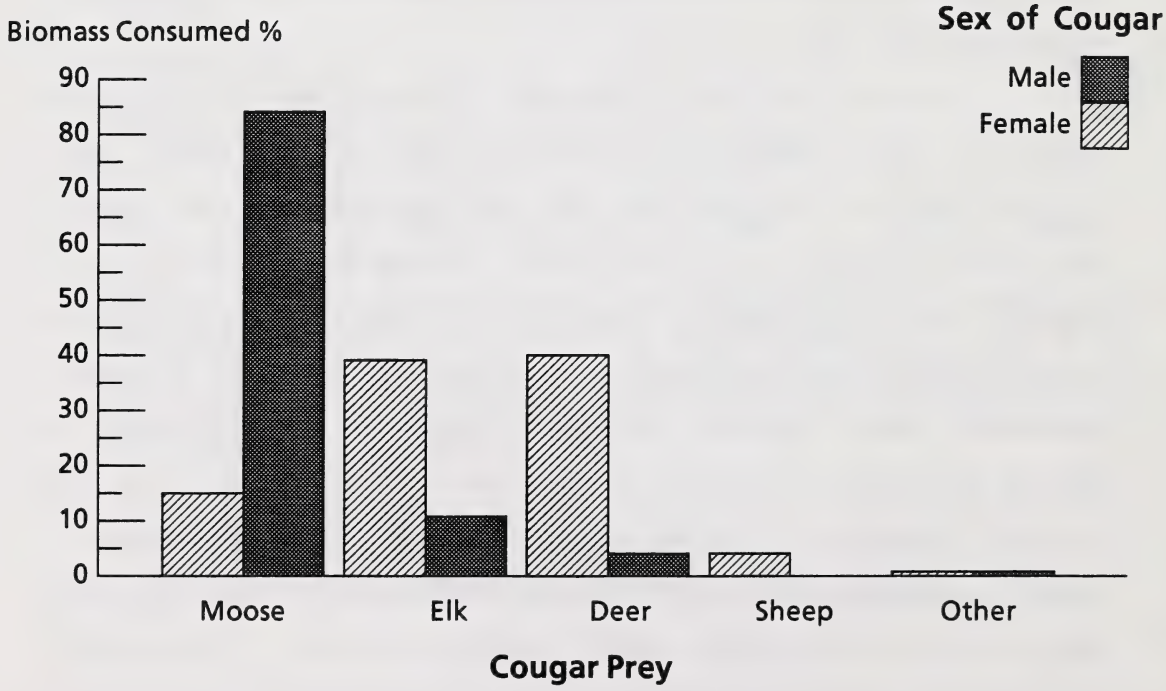


Figure 2. Prey biomass consumed by cougars during winter at sites in and around the Sheep River area, Alberta between 1981 and 1989 (biomass consumed for each prey species is a proportion of total prey biomass consumed by each sex of cougar).

Bighorn sheep (Ovis canadensis) were apparently not important to the diet of cougars in the Sheep River study area; only three cases of bighorn predation by cougars were found between 1982 and 1988. On a study area in the East Kootenays of British Columbia, bighorn sheep were present but were similarly not preyed on to any great degree (Spreadbury 1988). In New Mexico and in southcentral British Columbia, cougars killed bighorn sheep more frequently (Evans 1983; Harrison and Hebert 1988). In both the Sheep River area and in the East Kootenays, plentiful alternative food sources were available. It may be that cougars do not spend time hunting sheep in these latter areas because time spent hunting deer, elk and moose is more productive. Because bighorns are most frequently found in herds on open grassy slopes which do not afford much stalking cover, sheep are probably more difficult prey for cougars to capture.

There was a strong relationship between cougar sex and the species of ungulate preyed upon in the Sheep River study. Male cougars killed moose more frequently than female cougars did (2.6:1), yet male cougars almost never killed elk. Elk, on the other hand, was the second most frequent prey item for female cougars, after deer. Deer, which comprised half of all prey occurrences for female cougars, represented less than one third of all prey items in the male diet.

In terms of biomass consumed, the importance of each prey species to male and female cougars stresses once more the importance of the larger ungulates to the diets of cougars in Alberta (Table 7, Figure 2). Although the frequency of deer in the female cougar kill sample was 2.5 times that of elk, elk were of equal importance in the diets of female cougars when respective prey weights were taken into account. The importance of moose to male cougars was similarly underestimated. This species represented 85

percent of total biomass consumed by male cougars in the study area.

Reasons for apparent dietary differences between cougar sexes are not evident. Since male cougars are 50 percent heavier than females, males should be able to kill larger prey more easily than females. However, females do kill moose and elk. In Banff National Park, cow elk 4 years of age and older have a mean weight of 259 kg (Flook 1970). Alaskan moose calves in March may weigh 200 kg (Franzmann et al. 1978). Nonetheless, elk were not commonly found in the diets of male cougars. Male and female cougars may have different hunting techniques or may hunt in different habitat types. Accordingly, the availability and/or the vulnerability of different species of prey may be different for male and female cougars.

Twelve kills made by 11 independent subadult and juvenile cougars were documented. These included five mule deer, four porcupines, one moose, one coyote, and one bighorn sheep. The moose was killed by a 19-month old, subadult male. Since they are relatively inexperienced hunters, younger cougars may attempt to kill a wider variety of prey and that variety may include more small mammals, such as porcupines.

Porcupine quills were found in 34 percent (28 of 83) of the cougar carcasses examined from a sample of carcasses submitted by hunters to the Alberta Fish and Wildlife Division (AF&W) between 1982 and 1985. Among known-age cougars, the I/II age class contained the highest percent frequency (63 percent) of quills, while the III and the >IV age class carcasses contained a substantially lower frequency. These data support the suggestion that the diet of young cougars may include more small mammals such as porcupines. Alternatively, young cougars may be less adept at killing porcupines than are older cougars, again resulting in the higher frequency of quills found in younger age groups.

The occurrence of porcupine quills in carcasses showed no significant relationship to sex of the cougars.

Physical condition of ungulates killed by cougars in the Sheep River area was determined from an analysis of marrow collected from femurs of cougar prey. Fifteen of 19 moose femurs collected from cougar kills in the Sheep River study area had fat content percentages of less than 25 percent; eight of these had less than 10 percent. Only one calf had over 50 percent fat content. Normal marrow fat values for moose calves in the winter are between 25 and 50 percent (Cederlund et al. 1986; Fong 1981; Franzmann and Arneson 1976). Most moose calves found in the cougar kill sample were in poor condition.

Twelve of 14 elk killed by cougars in the Sheep River study had marrow fat values above 50 percent. Bubenik (1982) stated that femur marrow fat content in elk during midwinter of 40 to 50 percent could indicate a potentially dangerous situation. Marrow fat values of mule deer killed by cougars in the Sheep River study varied between 0.5 and 96.5 percent. High marrow fat percentages alone do not indicate that an ungulate was in good condition when it was killed (Mech and Delgiudice 1985). The effect of body condition on the vulnerability of elk and mule deer to cougar predation in the Sheep River area remains unknown.

2.2.7.2 Consumption Rates and Prey Selection

Consumption rates of wild cougars have been estimated from data collected by tracking cougars, consumption rates of captive animals, and estimates of cougar energy requirements. In Idaho (Hornocker 1970), Arizona (Shaw 1977), Utah (Ackerman 1982; Robinette et al. 1959) and Nevada (Robinette et al. 1959), the estimated frequencies of cougar kills varied

from 1 deer per 16.1 days to 1 deer per 3.1 days. Higher kill rates were usually associated with female cougars accompanied by large dependent young, while the lowest kill rates were estimated for solitary adult females. Since the collection of information on food habits was a secondary objective in the Sheep River study, consumption rates were not determined.

Radio-collared cougars usually remained at kills until all available meat was consumed. The time required for consumption depended on the size of the prey and the cougar(s) involved. Females that were accompanied by large juveniles consumed prey more quickly than any other sex-age class. In one such case, a female with two juveniles, a male and a female about 14 months old, completely consumed a mule deer fawn in a single feeding. Conversely, a solitary subadult female remained for at least seven days in the vicinity of a moose calf she had killed. In two cases, adult male cougars left moose calves, on which they had been feeding, before the carcasses were completely consumed and then returned, several days later, to feed again.

2.2.7.3 Predation on Livestock

Historically, the cougar's reputation has been that of a sheep and cattle killer (Millar 1916; Hornocker 1969), but in most states and provinces, cattle depredations are not a serious problem (e.g., Ashman et al. 1983; Sitton 1978). In Texas and Arizona where depredations of cattle have occurred, cougars primarily killed young calves (Shaw 1977; Shaw et al. 1988; B. Thompson, Texas Parks and Wildl., pers. comm., 1988) and depredations were eliminated when young calves were confined to areas without cougars. In states where sheep ranching is common, cougar depredation is more problematic [for example in Nevada, (Ashman et al.

1983)]. Wherever sheep are grazed in cougar habitat, losses do occur. However, sheep losses are typically a very small percentage of the total sheep population using cougar habitat. In Alberta, cougar predation of sheep, cattle, goats, horses, dogs, poultry and swine have been reported (AF&W AIRS, R. Hanson, pers. comm., 1990)

Depredation problems are almost exclusively dealt with on an individual basis in all states and provinces. When depredations occur, the offending animal is often removed. A second strategy has been tried in New Mexico. Up to 14 cougars were removed annually by depredation control officers from management unit areas that suffered chronic cougar depredation problems. The results of the experiment were difficult to evaluate because of the difficulty of censusing cougars in the rough terrain (Jenks 1989).

2.2.8 Diseases and Parasites

Like most carnivores, cougars are the final host for a variety of internal parasites. Of these, *Trichinella* sp. has been reported most often. In two Alberta studies, cougar carcass infection rates were 56 percent (Dies and Gunson 1984), and 58 percent (Pall et al. 1988). Anderson (1983) reported that 61 percent of a sample of cougar carcasses from Montana tested positive for *Trichinella* sp. Spreadbury (1988) tested three cougar carcasses from southeastern British Columbia and found *Taenia omissa* in all three, *Toxocara cati* in two, and *Toxascaris leonina* in one. Anderson (1983) found no reports of evidence of detrimental effects of any parasite on the health of wild cougars.

A bacterial infection (*Streptococcus canis*) was likely responsible for the death of one radio-collared cougar in Alberta (Pall et al. 1988). Disease of all types, including rabies, is generally considered rare in wild

cougar populations and no disease or parasite is considered to be population limiting to cougars (Anderson 1983).

2.3 Current Status, Use and Management of Cougar in Alberta

2.3.1 Sheep River Population

Population dynamics of a hunted cougar population were studied in the foothills and mountains southwest of Calgary between 1982 and 1990. Seventy cougars were handled during a total of over 125 captures in the 780 km^2 study area. Most cougars were radio-collared and over 3000 radio locations were documented. Between 1984 and 1990, density estimates of the total cougar population (including dependent juveniles and kittens) in the study area were 2.7 to 5.8 cougars/100 km^2 (mean = 4.3 cougars/100 km^2).

2.3.2 Distribution and Numbers in Alberta

Cougars currently occupy about 72 000 km^2 of provincial lands located primarily in the foothills and mountains of southwestern Alberta (Figure 1). The area of habitat suitable for cougars was determined by estimating the areas of each of the seven following vegetative cover types (Strong and Leggat 1981): deciduous-dominated groveland, deciduous-dominated parkland, coniferous forest, deciduous forest, deciduous-dominated mixed forest, and coniferous-dominated mixed forest. In addition, cougars are found in Waterton Lakes, Banff, and Jasper national parks, an area of about 17 580 km^2. Cougar sightings and complaints are reported from other areas including southern portions of the Peace River Region.

Cougar density estimates in the province were based on the density estimates determined from the Sheep River area. Because cougar habitats south of the Bow River are ecologically similar to those in the Sheep River

area, similar density estimates relative to vegetative cover types in the latter area were applied to cougar habitats in the former area (Figure 3). Densities north of the Bow River were estimated after consultation with regional wildlife biologists and houndsmen experienced in those areas. These individuals were asked to estimate the density of cougars in the north relative to areas in southern Alberta. Since only two houndsmen contacted had experience in both the southern and northern areas of cougar range in Alberta, the density estimates applied to Wildlife Management Units (WMUs) north of the Bow River should be considered crude. There may be considerable variations in cougar density in the north depending on local ungulate population levels. Density estimates applied to cougar range north of the Bow River varied from 2.0 cougars/100 km^2 in the southern portion of the area to 0.1 cougars/100 km^2 in the north (Figure 3).

Cougar densities in Waterton Lakes, Banff, and Jasper national parks were estimated using estimates from adjacent provincial lands as guides. Because all three parks are more mountainous and generally have higher snow accumulations than adjacent provincial lands, the density estimates used for the parks were lower than density estimates in contiguous habitat. Estimates of 2.0, 0.5 and 0.25 cougars/100 km^2 were applied to Waterton Lakes, Banff, and Jasper national parks, respectively. Track surveys conducted in Jasper and Banff national parks support the conclusion that cougars are rare in both parks (Holroyd and Van Tighem 1983).

Four other mountainous reserves in Alberta support unhunted cougar populations and are assigned density estimates based on those of adjacent national parks. Estimated cougar densities for Peter Lougheed Provincial Park, and the Ghost River, Siffleur, and Whitegoat wilderness areas were 1.0, 0.5, 0.5 and 0.25 cougars per 100 km^2, respectively.

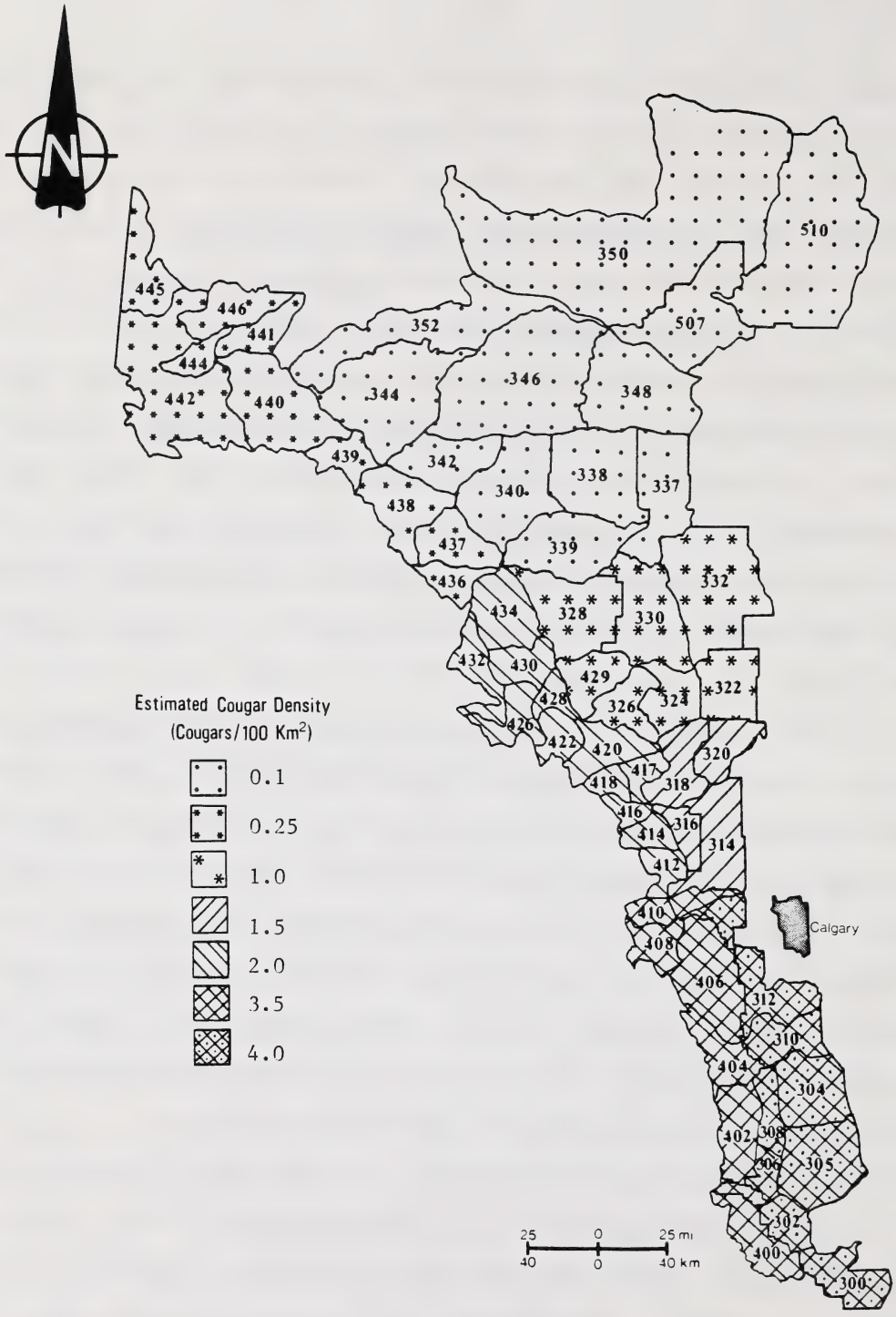


Figure 3. Estimated cougar densities in Wildlife Management Units open to cougar hunting in Alberta.

Although the southern portion of the Peace River Region (formerly Big Game Zone 2) is open to cougar hunting, and cougars are found, at least occasionally according to depredation reports and AIRS data, no density estimate was applied to the area. R. Bjorge (AF&W manager, pers. comm.) reported several cougar sightings during the period 1975-1986 in WMU 356, which extends south of Grande Prairie and along the Smoky River to its confluence with the Peace River. Generally, however, most of the southern Peace River Region has few cougar (R. McFetridge, AF&W manager, pers. comm., 1988). Similarly, areas along the major river valleys east of known cougar range in Alberta have had occasional sightings. However, it appears unlikely that resident populations exist in these areas.

A provincial population estimate of approximately 685 cougars was calculated based on the density estimates and the total available cougar habitat on provincial lands and in the three national parks. Cougar population estimates for Waterton Lakes, Banff and Jasper national parks are 7, 22 and 16, respectively, while Peter Lougheed Provincial Park and the three wilderness areas together support an estimated 10 cougars, for a total of 55 in parks and reserves. Approximately 630 cougars occur on other provincial lands (Table 8). The most productive cougar habitat in Alberta is found in the extreme southwest. This area, south of the Bow River, includes just 15 percent of all cougar habitat on provincial lands, yet has an estimated population of 385 cougars or 61 percent of the total population on provincial lands.

2.3.3 Recreational Hunting

2.3.3.1 Licence Sales

Cougar licence sales between 1973-74 and 1979-80 generally

Table 8. Estimated cougar populations in former[a] Big Game Zones (BGZs) open to cougar hunting in Alberta.

BGZ[b]	Cougar habitat[c] (km^2)	Density estimate (cougars/100 km^2)	Population estimate (cougars)
3	32 063	0.1 - 0.75	85
4	13 356	0.25- 1.5	95
5[d]	2 283	3.5	80
6	1 531	3.5	55
7	7 030	1.5 - 4.0	245
13	15 393	0.1 - 2.0	70
Total	71 656	0.1 - 4.0	630

[a]the Big Game Zone system terminated in 1989.
[b]BGZ 2 is not included since the cougar population there is low.
[c]total area from AF&W Computer Graphics (Intergraph 48,000 Workstation), but factored down for habitats with little or no cougar use.
[d]includes Wildlife Management Unit 410.

increased, but have fluctuated since then (Figure 4). Since cougars could be hunted under the authority of an elk licence in 1971 and 1972, the number of cougar licences sold underestimates the number of cougar hunters in those years. Licence sales peaked in 1979-80 when 173 were sold. The lowest recorded total sale since that peak was in 1985-86 when only 105 were sold. Resident licences account for the bulk of all cougar licences sold between 1971 and 1986; total sales to non-residents and non-resident aliens accounted for only 3 to 10 percent of all licences sold annually. During the three most recent years, 1987-88 to 1989-90, sales averaged 112 licences (range 102-128).

2.3.3.2 Harvest

Between 1973-74 and 1989-90, the average annual harvest by hunters has been 32 cougars (range 21 to 47) (Figure 5). Recorded harvests during 1971-1973 are not included in this average because of a suspected low level of compliance with the (then-new) compulsory registration system.

Residents are responsible for most of the cougar harvest every year. Between 1973-74 and 1989-90, non-residents and non-resident aliens have harvested between 0 and 11 cougars annually, for 0 to 33 percent of the annual harvest. The success rate of non-residents and non-resident aliens is considerably higher than that of resident cougar hunters. Between 1973-74 and 1989-90, 57 percent (75 cougar, 131 licencees) of non-residents and non-resident aliens harvested a cougar. Among resident hunters during the same period, the success rate was 24 percent (467 cougar, 1967 licencees).

The size of the provincial cougar harvest is affected by many factors to varying degrees, which combine to produce the harvest

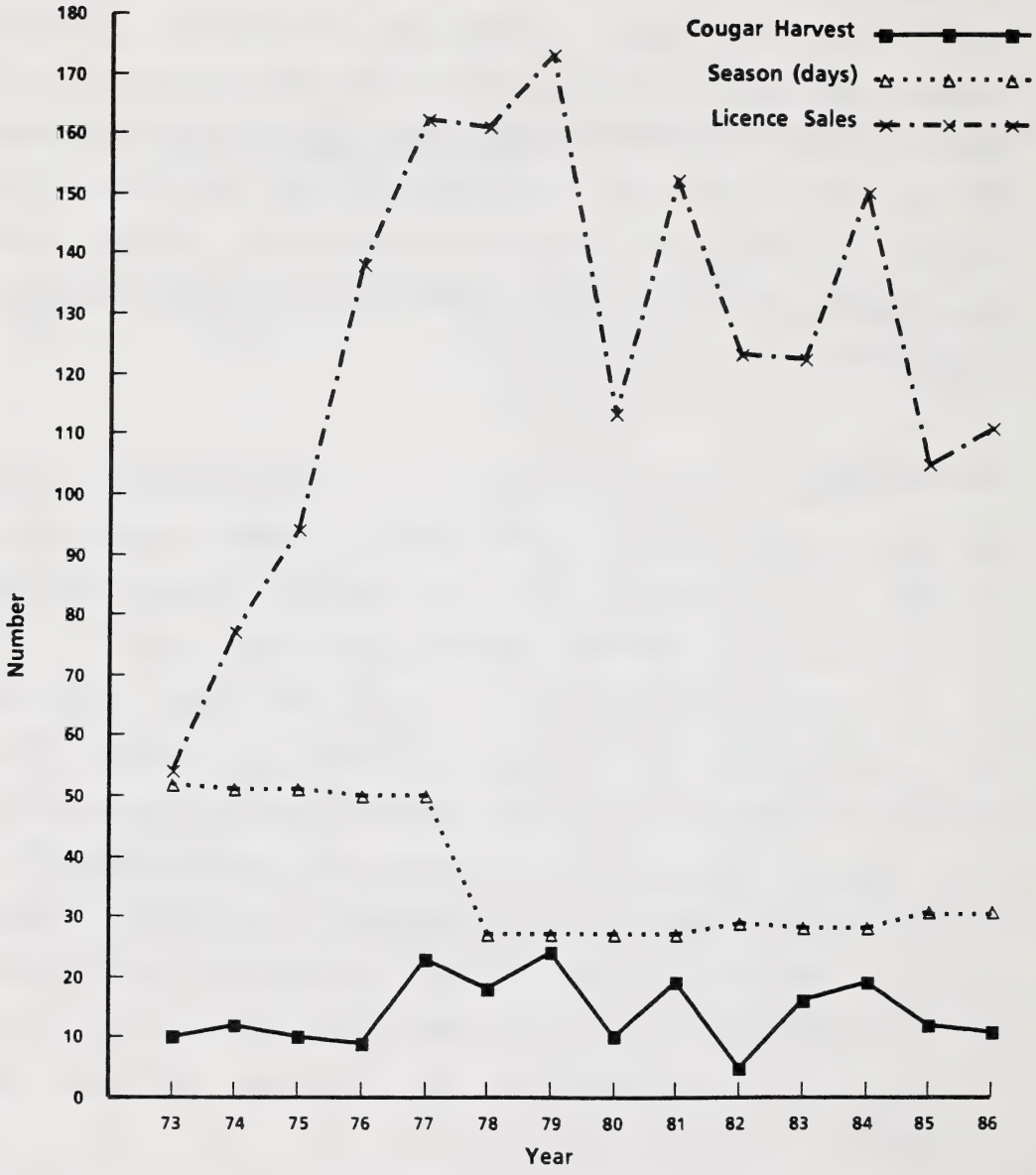


Figure 4. Comparison of total provincial licence sales, season length, and cougar harvest in WMUs 300 - 312 (southern foothills) in Alberta, 1973 - 74 to 1986 - 87.

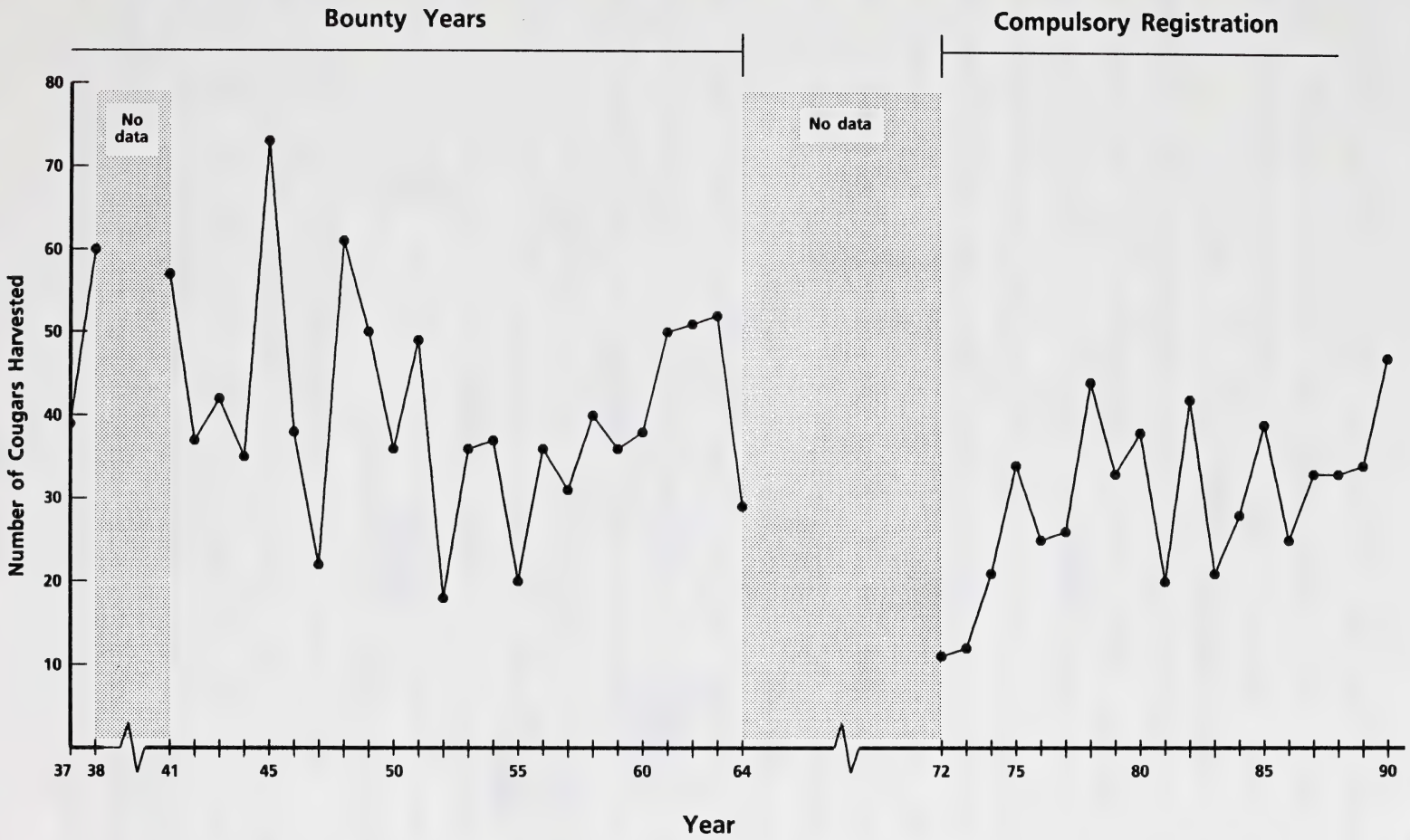


Figure 5. The cougar harvest in Alberta, 1936 - 37 to 1989 - 90.

fluctuations. Such factors include the following: the cougar population level, winter hunting season length, snow conditions during the winter hunting season, the number and quality of guides available with hounds, the number of licences sold, and changes to motorized access.

The condition of snow during the winter hunting season is probably the most important factor in determining the harvest. If fresh snow is not present, the likelihood of finding cougar tracks is greatly diminished. Based on observations while in the field during the January hunting seasons and from discussions with cougar hunting guides, 1981 and 1983 were both very poor snow years. Harvests in 1981 and 1983 were about 50 percent less than the average annual harvest between 1974 and 1987. Snow conditions were very good during the interceding winter and the number of cougars killed rose to more than 150 percent of the average annual harvest.

Snow conditions seemed to mask the effects of other factors on the harvest. Major changes in the length of the winter season between 1978 and 1980 did not produce any dramatic changes in the cougar harvest in WMUs 300-312 (Figure 4). Changing licence sales have the potential to affect the total kill, but licence sales have fluctuated since the length of the season was reduced, probably in response to the prevailing snow conditions during each hunting season. From 1974 to 1980, licence sales tripled, yet harvest levels did not increase correspondingly.

Cougar harvests within individual WMUs also vary considerably between years. In the southern part of the province, WMUs 302, 304/305, 306, 312, 314, 318, 400 and 406 all had one or more years when cougar harvests were much higher than preceding years (Figure 6). In most cases, these years were followed by years when the cougar harvest fell well below the average for the WMU. There also appears to be an overall downward trend

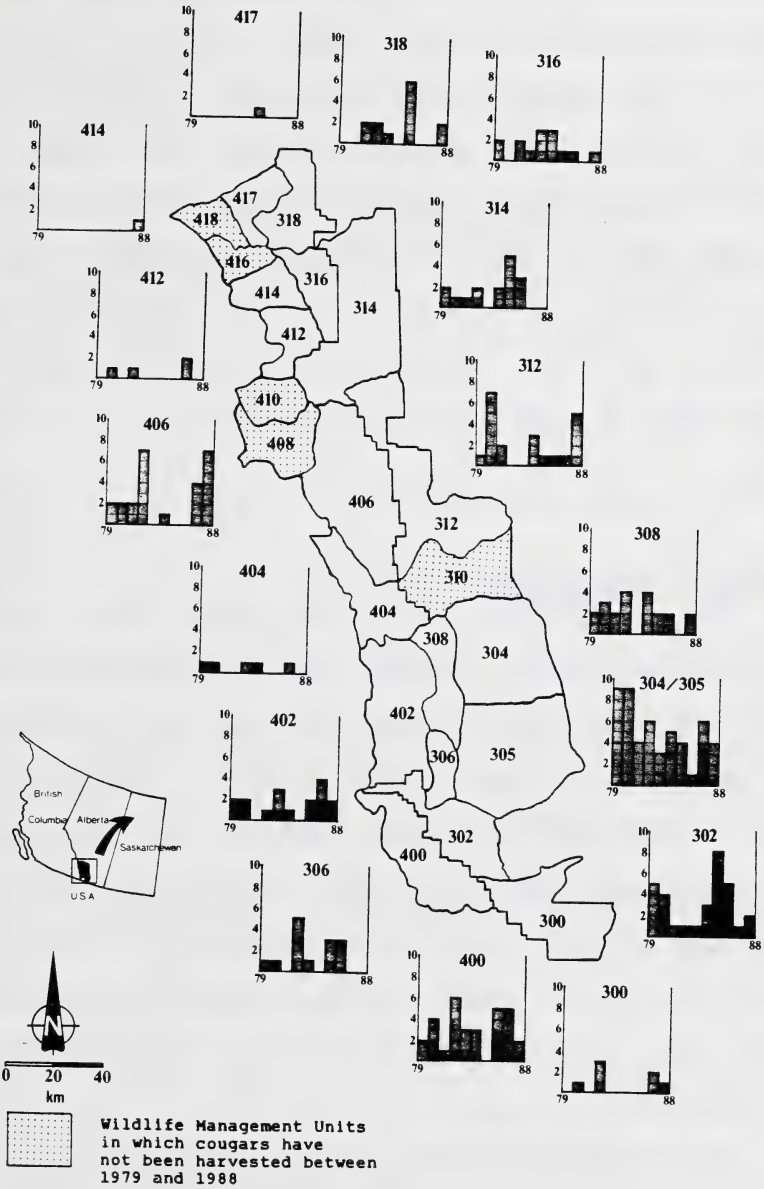


Figure 6. Annual cougar harvests in individual Wildlife Management Units open to cougar hunting in southwestern Alberta, 1979-1988.

in the harvest within WMUs 304/305 since nine cougars were taken in 1979 and in 1980.

The high cougar harvests in some WMUs in some years may represent overharvest of the cougar population in those WMUs. When harvests were converted to harvest density (number of cougars killed/100 km^2), instances where annual harvests in individual WMUs exceeded 20 percent of the estimated populations in those WMUs occurred 17 times (15 percent) between 1979 and 1988 (Table 9). Average annual harvests in individual WMUs over the period 1979 to 1988 were between 0 and 16 percent of the estimated populations.

2.3.3.3 Harvest Distribution

The distribution of the annual cougar harvest between 1972 and 1988 has been very uneven. Between 1979 and 1988, cougars were killed in only 13 to 25 percent of all WMUs across the province that were open to cougar hunting. Most cougars were harvested in the WMUs located in the southwestern part of the province. However, the distribution of kills across these southern WMUs is also not uniform (Figure 6). The greatest harvests have continually come from the Porcupine Hills (WMUs 304/305). In contrast, WMU 310 has not had a single recorded cougar kill during the entire 16 years. Northern WMUs have individual kills recorded in them at sporadic intervals.

The distribution of the harvest in Alberta is dictated by the relative densities of cougars in WMUs open to cougar hunting, the distribution of cougar hunting guides, snow conditions, and vehicular accessibility. The majority of the cougar harvest in the province has traditionally come from the WMUs south of the Bow River because it is probably the most

Table 9. Harvest of cougar in southern Wildlife Management Units between 1979 and 1988.

Year		Wildlife Management Unit										
		302	304-5	306	308	312	314	316	318	400	402	406
1979	number	5	9	1	2	1	2	2	0	2	2	2
	density[a]	0.88[b]	0.70	0.36	0.41	0.08	0.13	0.44[b]	0	0.29	0.24	0.16
1980	number	4	9	1	3	7	1	0	0	4	2	2
	density	0.71[b]	0.70	0.36	0.61	0.56	0.06	0	0	0.58	0.24	0.16
1981	number	1	4	0	2	2	1	2	2	1	0	2
	density	0.12	0.31	0	0.41	0.16	0.06	0.44[b]	0.33	0.14	0	0.16
1982	number	1	6	5	4	0	2	1	2	6	1	7
	density	0.12	0.46	1.80[b]	0.82[b]	0	0.13	0.22	0.33	0.87[b]	0.12	0.55
1983	number	1	3	1	2	0	0	3	1	3	3	0
	density	0.12	0.23	0.36	0.41	0	0	0.66[b]	0.16	0.43	0.36	0
1984	number	3	5	0	0	3	2	3	0	3	1	1
	density	0.53	0.39	0	0	0.24	0.13	0.66[b]	0	0.43	0.12	0.08
1985	number	8	4	3	2	1	5	1	6	0	0	0
	density	1.41[b]	0.31	1.1[b]	0.41	0.08	0.32[b]	0.22	0.99	0	0	0
1986	number	5	1	3	2	1	3	1	0	5	2	0
	density	0.88[b]	0.08	1.1[b]	0.41	0.08	0.19	0.22	0	0.72[b]	0.24	0
1987	number	1	6	0	0	1	0	0	0	5	4	4
	density	0.12	0.46	0	0	0.08	0	0	0	0.72[b]	0.48	0.31
1988	number	2	4	2	2	5	0	1	2	2	1	7
	density	0.35	0.31	0.72[b]	0.41	0.40	0	0.22	0.33	0.29	0.12	0.55
Average annual cougar harvest	number	3.1	4.9	1.6	2.1	2.1	1.6	1.4	1.3	3.1	1.6	2.5
	density	0.55	0.38	0.58	0.43	0.17	0.10	0.32	0.21	0.45	0.19	0.20

[a]number of cougars legally harvested per 100 km^2 of cougar habitat in each WMU.
[b]harvest exceeded 20 percent of estimated population.

productive cougar habitat in the province, there are more cougar hunting guides living in the vicinity, and access is generally very good. This is particularly true in the Porcupine Hills (WMU 304/305). The hills are excellent wintering range for elk and deer, several guides live nearby, and because they are an undeveloped island surrounded by agricultural land, motorized access is good. In addition, because the Porcupine Hills are in close proximity to good cougar habitat to the west and there are no major barriers to movement of cougars between the two areas, ingress of cougars is probably common.

If snow conditions are better in some areas open to cougar hunting than in others, a redistribution of harvest can occur. In 1985, snow conditions were very poor in southern WMUs, while further north they were appreciably better. More cougars were shot that year in WMUs 314, 316 and 318 than in previous years, while farther south the harvest was below average.

There is excellent cougar habitat in, and cougar guides live in close proximity to, WMU 406, where the Sheep River cougar study was conducted. However, motorized access was sharply curtailed in 1983 creating a de facto sanctuary in most of the WMU. Harvests have been reduced in the western half of the unit since the closure; the majority now occur along the eastern fringe and in the McLean Creek Off-Highway Vehicle Zone where motorized access is still permitted. In this case, the changes in motorized access resulted in a redistribution of the cougar harvest in the WMU.

Cougars were harvested from WMU 320 for six consecutive years between 1974 and 1979. Since then, there has been no harvest from the area. As mentioned above, compulsory registration records show that no cougars have been harvested from WMU 310 in the last 16 years. Its habitat is similar to that of its neighbors and large deer and elk populations occur

there. In both cases outlined above, the change in or lack of harvest can be attributed to the absence of hunting pressure. This has probably been accentuated by poor snow conditions and the shortening of the cougar season. Access to private land may be a factor in WMU 310. Since guides are more likely to first check cougar habitat in the immediate vicinity of their residence after fresh snow, fewer trips are made farther afield if good snow conditions do not persist and if the number of days to hunt cougars declines.

2.3.3.4 Sex Ratio of the Harvest

The sex ratio of the annual cougar harvest has varied considerably between 1974 and 1988 (Figure 7). During that period, 45 percent of all cougar kills were females.

Season length may affect the sex ratio of the cougar harvest. In WMUs 300 to 312, the sex ratio of the harvest between 1974 and 1978, when the winter cougar season was 51 to 52 days in length, was 1f:1.5m. Between 1979 and 1988, when the season was reduced to a period of 26 to 31 days, the harvest was only slightly skewed toward males, 1f:1.1m.

Snow conditions during the hunting season will affect the sex ratio of the harvest. If snow conditions are poor (i.e., little or no snow), there may be fewer opportunities to tree cougars, resulting in less choice for the hunter who wants to fill his tag. Many hunters, particularly first-time hunters, would probably shoot a smaller cougar, which is more likely a female, than not shoot a cougar at all. This situation may be exacerbated by a shortened season since the opportunities for better snow conditions are fewer.

Guides may influence the sex ratio of the harvest. Experienced

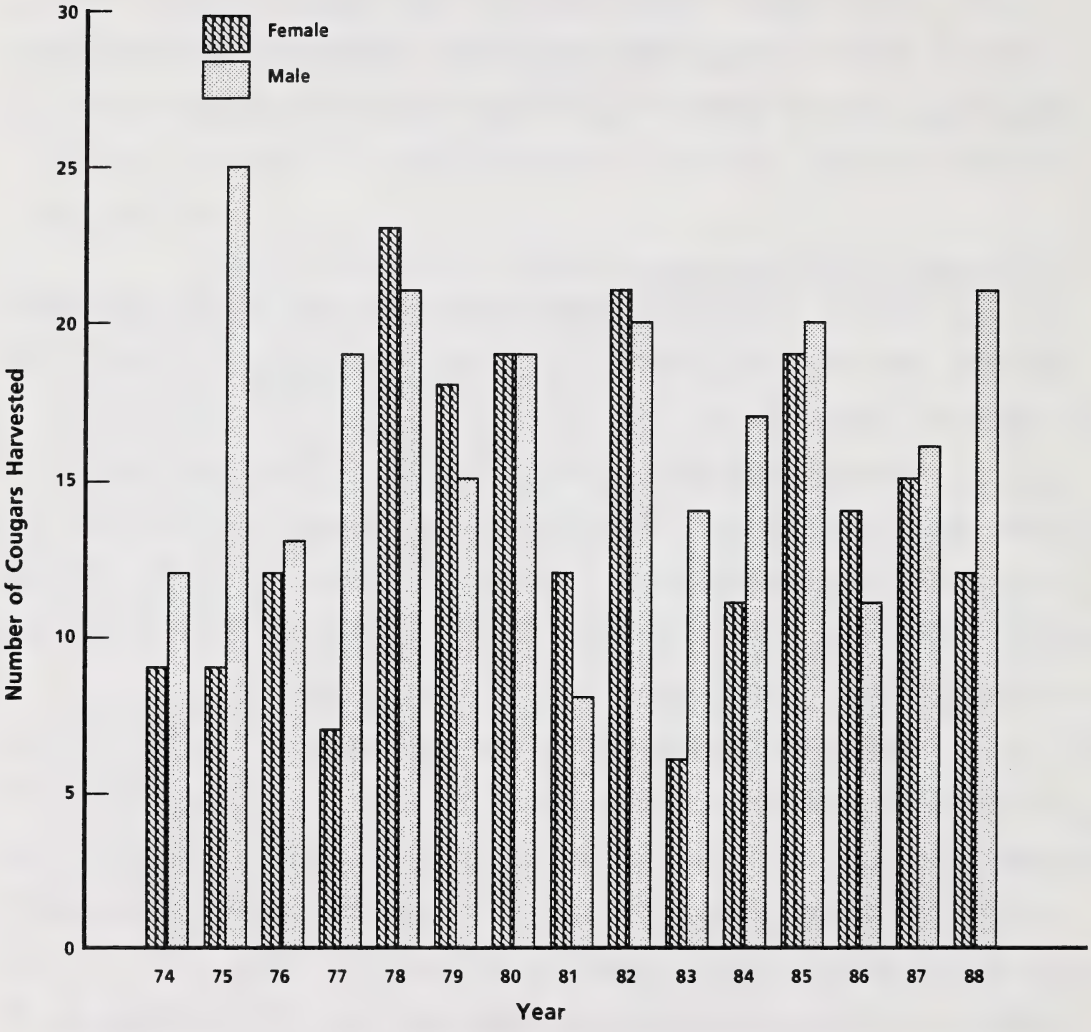


Figure 7. Sex ratio of cougars harvested in Alberta from 1973 to 1988.

guides can differentiate the tracks of adult male cougars from others. They can also make a reasonable judgement about the sex of a treed cougar, and may encourage hunters to take males. For example, between 1974 and 1979, 15 males and only three females were harvested in WMU 320. Whoever was hunting in the unit during that period probably preferred to harvest males. However, the actions of guides are mediated by the length of the season and snow conditions. Shorter seasons and poor snow conditions probably reduce the likelihood of a guide recommending that a treed female be spared.

2.3.3.5 Age Distribution of the Harvest

Since 1982, a total of 159 skulls of hunter-killed cougars, or about two-thirds of all cougars registered, has been voluntarily submitted to the Alberta Fish and Wildlife Division for aging. Greer's (1972) aging system was used.

Mature adult age classes (V - IX) represented the majority of the aged skull sample, followed by the young adult (III, IV) and subadult classes (kittens, I, II) (Table 10). Adults aged as class VII or greater represented 59 percent of all mature adult cougar skulls submitted.

These results suggest that from a provincial perspective the cougar population in Alberta is not overhunted. Although older cougars are harvested more often than younger cougars, these data do not indicate whether hunters are selecting for older cougars. To determine if there is such selection, the sex-age structure of the harvest must be compared to the sex-age structure of the cougar population.

The sex-age structure of the cougar population in Alberta was estimated using information regarding the cougars in the Sheep River area between 1984 and 1989. Although the population structure of cougars

Table 10. Sex-age structure of the cougars harvested in all Wildlife Management Units open to cougar hunting in Alberta: 1982 to 1988.

Age class		Male	(%)	Female	(%)	Total	(%)
Subadult	kitten	4		2			
	I-II	13		12			
	subtotal	17		14		31	(19)
Young adult	III	9		17			
	IV	8		10			
	subtotal	17		27		44	(28)
Mature adult	V	6		6			
	VI	12		11			
	VII+	24		25			
	subtotal	42		42		84	(53)
Total		76	(48)	83	(52)	159	

throughout the province probably varies considerably depending on the wide variety of ecological conditions and the level of harvest in different areas, the Sheep River population should provide a useful model. The Sheep River area is ecologically representative of many areas in southern Alberta where the majority of the harvest takes place. However, because the harvest rates in the study area were well below those of many WMUs when the study was underway, the comparison should be considered a rough estimate only.

To facilitate the comparison, the sex-age structure of the two samples must be in the same format using the same age classification system. During the Sheep River study, the following age classification system was adopted: kittens (0-0.5 years), juveniles (0.6-1.5 years), subadults (1.6-2.5 years), and adults (>2.5 years). The huntable cougar population in the study area included adults and those juveniles and subadults that are independent. The adult group is best represented in the skull age classification system by age classes IV and above. Independent juveniles and subadults are best represented by the combined age classes I, II and III.

Adults and independent subadults and juveniles were harvested in similar proportions to their frequency in the Sheep River study area population. However, if the age classes are categorized according to sex, a different picture emerges. Male adults and independent juvenile and subadult males represented 33 and 14 percent of the aged harvest sample, respectively (Table 11), while in the Sheep River area, these same groups represented about 19-22 and 7-12 percent of the population (Table 12). Conversely, adult and independent subadult and juvenile females represent 65-75 percent of the huntable population and make up just over half the harvest. Since adult and subadult males are the two sex-age groups with the

Table 11. Independent sex-age classes of cougar harvested in Alberta: 1982 to 1988.

Age class		Male	(%)	Female	(%)	Total	(%)
Subadult	I-II	13		12		25	
	III	9		17		26	
	subtotal	22	(14)	29	(19)	51	(33)
Adults	IV	8		10		18	
	V	6		6		12	
	VI	12		11		23	
	VII+	24		25		49	
	subtotal	50	(33)	52	(34)	102	(67)
Total		72	(47)	81	(53)	153	

Table 12. Estimated percentages of independent sex-age classes in the Sheep River cougar population between 1984 and 1989.

	Percent		
Age class	Male	Female	Both sexes
Adults	19-22	47-53	67-75
Independent juveniles and subadults	7-12	18-22	25-34
All independent cougars	27-34	65-75	100

physically largest animals in cougar populations, these results support the argument that hunters in Alberta do select for larger cougars.

Wildlife Management Units 302, 304/305, and 400 have sustained the heaviest harvest in Alberta. The sex-age ratio of the kill in these three WMUs appears to be different from the ratio of the kill in all areas outside those WMUs (Figure 8). Subadult males and females in these three WMUs were shot more frequently than in all other WMUs. Conversely, the harvest of adult females in WMUs 302, 304/305, 400 was less than in the province-wide harvest. The percentages of adult males were similar in the two harvests.

The different percentages of cougars harvested in each sex-age class are probably the result of two factors. First, if the heavy harvest in these units resulted in a population which was younger than that found elsewhere, then the likelihood of harvesting older cougars would decrease. This would account for the higher proportion of both subadult males and females. Since this age class is often transient (Hornocker 1970), they would be the first to take advantage of vacancies created by heavy hunting pressure. In addition, the higher proportion of subadult males may occur because cougars in this sex-age class are physically larger than most females and, therefore, may be selected over females. Reasons for similar harvests of adult males both in the heavily harvested units and elsewhere are not clear.

2.3.4 Aesthetics

Cougars are a very important wildlife species to many people in Alberta. In a survey of user/recreationists, houndsmen, ranchers, and resource managers living in southwestern Alberta, Horejsi et al. (1982)

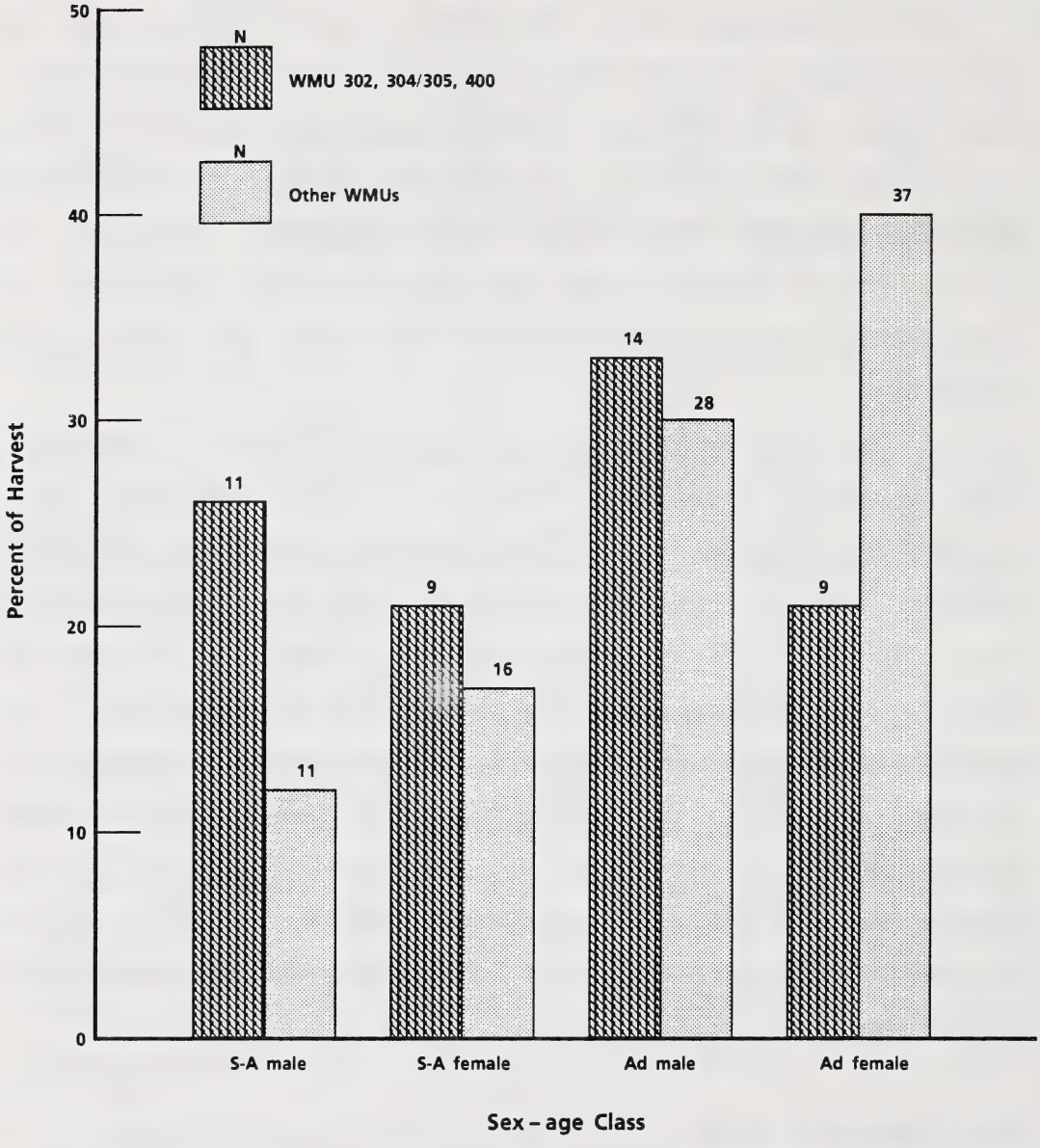


Figure 8. Harvests of cougar within and outside WMUs 302, 304/305, and 400 during 1982 - 1988 (S-A:subadult; Ad:adult).

found that a majority of respondents (65 of 69) felt that they benefited in some way from the presence of cougars. These results are similar to those of a more generalized survey of the attitudes of Canadians to wildlife. When asked to indicate how important maintaining abundant wildlife was to them, 87 percent of Albertans surveyed indicated that it was fairly or very important (Filion et al. 1983).

2.3.5 Bounty Management

Clark and Vriend (1980) chronicled the changing cougar management policies in Alberta. A bounty, which started at $15 and eventually rose to $40, was paid by the Alberta government for dead cougars between 1937 and 1964. The cougar harvest fluctuated considerably during the bounty years (Figure 5). During those years, the average annual kill was 40.

2.3.6 Hunting Management

In 1969, the first cougar season was declared, although a licence for elk, moose or deer was sufficient to legally hunt cougars. Those first seasons were open from September through the following March, with the use of dogs permitted only during January, February and March.

The cougar was designated a big game animal in 1971 and a licence for cougar hunting was introduced. In addition, a resident hunter in possession of a $10 elk licence was allowed to hunt cougar. Non-residents were also allowed to hunt cougars with an elk licence; however, their elk licence cost $100. There were no restrictions on the number of licences sold and licence holders were permitted to hunt in any WMU open to cougar hunting. The bag limit was set at one cougar per year. In 1972, a resident cougar licence cost $25, while non-residents paid $75. The bag limit

remained at one cougar per year. In 1973, the cost of the resident licence for cougars was reduced to $10.

Cougar licence fees then remained unchanged until 1980. In that year, the cost of a cougar licence increased to $20, $100 and $200 for residents, non-residents and non-resident aliens, respectively. Beginning in 1982, kittens with spotted fur and female cougars accompanied by kittens were protected. Hunters were still limited to one cougar per year and those in possession of a valid cougar licence could hunt in any WMU with a cougar season. These regulations remained unchanged through 1989.

Between 1971 and 1977, the length of the winter season (with dogs) was about 50 to 60 days between the beginning of December and the end of January. In 1978, the winter season was limited to January in WMUs 300-312. All other WMUs open to cougar hunting continued with the two-month season. In 1981, winter season length in all WMUs open to cougar hunting was reduced to the month of January. In 1990, the cougar season was increased to three months, 1 Dec. - 28 Feb., because regional harvests were controlled by a quota system described in Section 3.0.

Between 1971 and 1979, fall seasons for cougar hunting (without dogs) varied between 81 and 100 days in length. In 1979-80, this was reduced to 66 days. This reduction occurred because the fall cougar season was made to correspond with the fall hunting season for other big game and these seasons had been reduced in length. In 1985, the fall hunting season for cougars was abolished.

Use of off-highway vehicles (OHVs) to hunt cougar has been restricted in WMUs 300-312 [Gen. Wildl. Reg. 50/87, Sec. 20 (4)]. The intent was to prohibit the use of OHVs, especially snowmachines, in

searching for cougar tracks while weapons or dogs were carried on or accompanied the OHV. This prohibition was implemented because of the practice of certain guides who searched for tracks before booking hunts (D. Radford, AF&W, unpubl.).

2.3.7 Nuisance/Problem Management

The Animal Incident Reporting System (AIRS) data base contains all instances for which Fish and Wildlife Division officers completed cougar occurrence reports since April 1982. Such reports range from actual depredation claims to sightings of animals. Because of the summary nature of the AIRS data base, the authenticity of each occurrence cannot be determined from the data base alone. An average of 54 occurrence reports were completed each year for cougars (Table 13). The majority, an average of 23 annually, were sightings. Livestock kills made by cougars accounted for about 13 occurrence reports each year. Mauling and harassment of livestock were reported on average 12 times each year. A few cases of harassment of humans have been reported each year except in 1982-83. Most occurrences were reported during the summer months.

The Alberta Livestock Predator Compensation Program (LPCP), administered by Alberta Agriculture (Hutchings 1986), compensates livestock owners for losses to predators. The program covers only food-producing stock (i.e., cases of predation on dogs and horses are not covered) and market values of a loss must exceed $100 per calendar year. Claims are reviewed by one of two regional committees composed of private producers and government representatives from animal health, production, and wildlife management interests. Losses have been judged as "confirmed kill,"

Table 13. Numbers of cougar complaints[a] in Alberta, stratified by complaint type.

Type of Complaint	Year					
	82-83	83-84	84-85	85-86	86-87	87-88
Livestock kill	18	10	15	13	8	16
Livestock mauling	7	4	5	6	3	4
Livestock harassment	8	5	8	6	9	5
Human harassment	0	3	2	4	3	2
Sightings	21	18	26	20	35	19
Other	5	2	2	4	3	5
All types	59	42	58	53	61	51

[a]data source - Animal Incident Reporting System (AIRS)

"probable kill" or "missing animal" with corresponding levels of compensation--up to 80 percent of commercial value, 50 and 30 percent (50 percent in the case of missing animals where an official third party count of livestock was made before the predation occurred). Loss includes fatality, injury from which recovery is deemed improbable, and the disappearance of animals in conjunction with confirmed kills or injuries. Changes to LPCP effective June 1990 include the following: 1) 100 percent compensation on confirmed kills and 2) elimination of the "missing animals" categories.

From 1974 through 1987, 61 claims for cougar predation on livestock were approved for compensation. The average number of claims per year was 4.4 (range: 2-9). The majority of the claims involved cattle (70 percent). Sheep accounted for 13 percent of the depredation incidents; goats, 8 percent; swine, 7 percent; and poultry, 3 percent. Cattle losses were considered more likely to be reported than poultry, given the relative value of the losses incurred.

In the majority of cattle incidents, only single animals were injured or killed. However, when the prey was smaller, multiple attacks usually occurred in each incident. Of 19 predation incidents involving sheep, goats, swine, and poultry, 15 were multiple kills. In one instance, a cougar killed 14 goats during a single night. During two attacks on poultry, single cougars killed 104 and 420 chickens.

Cougars preying on cattle in Alberta appeared to select calves over yearlings and adults, lambs were killed more often than adult sheep, and pigs less than 6 months old were taken more frequently than adults.

Cougar depredation on livestock was recorded for all months of the year. Predation was lowest from November through February, increased in

March, peaked in June and then declined in July. The peak in predation, between March and June, coincides with calving season. A similar peak during this time has been observed for coyote-cattle and black bear-cattle predation incidents in Alberta (Dorrance 1982; Horstman and Gunson 1982) and cougar-cattle predation incidents in Arizona (Shaw 1981). A second predation peak was observed in October when swine losses seemed highest. This was also observed by Horstman and Gunson (1982) for black bear-swine predation incidents in Alberta.

For every approved cougar depredation claim in southern Alberta, there were 5 wolf, 13 bear (includes both black and grizzly) and 42 coyote claims approved between 1974 and 1983 (Pall et al. 1988). Annually, total indemnity payments for depredation claims for all of Alberta averaged $1617 for cougar, $19 131 for wolves, $20 764 for bears and $82 528 for coyotes.

2.4 Summary And Management Issues

2.4.1 Summary of Status, Use and Management

The distribution of cougars in Alberta in historic times included all areas along the foothills and mountains from the 49th Parallel to Grande Prairie, as well as areas within the South Saskatchewan River drainage to the east. Because of their secretive nature, their numbers historically are largely a matter of conjecture. The distribution of cougars today is similar to the historic distribution in the foothills and mountains. This range is contiguous with occupied cougar habitat in British Columbia and the USA. Cougars are no longer found regularly along the major river drainages to the east of the foothills.

The provincial cougar population today is estimated at about 685.

Of these, about 640 are found on provincial lands while the remaining 45 occur in national parks. Since this estimate is based on one intensive cougar study in the southwestern portion of the cougar's range in Alberta, with extrapolations to other areas of the province, it should be considered a crude estimate at best. In southern Alberta, where ecological conditions are similar to the study area, the estimate should be good. However, in the northern portion of the cougar's range, ecological conditions are very different, so the validity of the estimate of cougar numbers in those areas is uncertain.

The average legal harvest in Alberta to 1988 was approximately 30 cougars. Most of that harvest is concentrated in the southern portion of the province where cougar densities are probably highest, and where most cougar houndsmen reside. Male cougars appear to be selected for by hunters, although females accounted for 45 percent of the harvest between 1973 and 1988. From a provincial perspective, the cougar population in the province is not being overharvested. However, individual WMUs in some years may experience overhunting.

Cougar depredation has not been a major problem in Alberta. An average of between four and five compensation claims resulting from confirmed or probable predation of food-producing livestock have been awarded each year since 1973.

2.4.2 Management Issues

A major management concern prior to 1990 was the imbalance in the distribution of cougar harvest in the province. Under the former general hunting season, harvest in individual WMUs was dictated by snow conditions. Overharvest in heavily hunted WMUs may have occurred in some winters. Often

the result was low harvests in those WMUs for subsequent years. Conversely, some WMUs with viable cougar populations remained unhunted.

A second problem is the lack of additional specific knowledge required for cougar management. Cougar densities in northern WMUs are unknown. Although none of these units are currently experiencing heavy hunting pressure, this could quickly change in the future if cougar hunting becomes more popular and the southern units cannot meet the demand. As well, evaluation of the effect of cougar predation on prey populations in Alberta requires more information. The Sheep River study showed that moose, elk, and deer were major prey items for cougars, but the ungulate response to this predation is unknown. Knowledge of predation rates for cougars elsewhere in North America is limited and what is available has been collected in areas that have very different ecological conditions (e.g., south-central Utah) and are therefore not directly applicable to Alberta.

A third problem is the poor general knowledge our increasingly urbanized human population has concerning wildlife in general and cougar in particular. Many people apparently do not know that cougars occur in Alberta (M. Jalkotzy, I. Ross unpubl.), and certainly do not have any understanding of cougars. This is often manifested as misunderstandings regarding human-wildlife interactions and wildlife management actions.

3.0 MANAGEMENT PLAN

3.1 Policy Framework

The Fish and Wildlife Policy for Alberta (Fish and Wildlife Division 1982) established, in the Wildlife Policy portion, goals for the administration of wildlife resources in Alberta. Quotes from this policy provide a framework for the formation of specific management plan goals for cougar and are set out under five general categories.

3.1.1 Resource Protection

"1) ... The primary consideration of the Government is to ensure that wildlife populations are protected from severe decline and that viable populations are maintained...."

3.1.2 Resource Allocation

"2) ...(a)The wildlife resource, as a Crown resource, will be utilized in a manner which contributes the most benefit to the citizens of Alberta.

"2) ...(e)Wildlife will be allocated through a defined process whereby specific resources are deployed to specified uses in order to achieve stated public benefits.

"11) The Division may allocate live wildlife for various uses such as game farming, game ranching, education or science and zoological displays, in conformity with other aspects of the Wildlife Policy.

"17) Wildlife must be allocated among different primary users in response to government policy. Until such time as supply and demand can be better rationalized, the following interim allocation guidelines will prevail

in order of priority:...

(b) Resident recreational use of game will have precedence over non-resident use. Wildlife stocks not fully allocated or utilized to higher priority uses may be allocated commercially to non-residents.

"18) The allocation of wildlife stocks to the different primary uses does not imply that other uses cannot occur within areas where such uses are entitled.

"22) ...[(b)(ii)](a)Formally allocating wildlife to tourist lodge and/or outfitter use."

3.1.3 Recreational Use

"8) A variety of wildlife recreational opportunities, in addition to hunting, will be available for the benefit and enjoyment of Albertans.

"21) A variety of hunting opportunities will be available for the recreational benefit and enjoyment of Albertans...."

3.1.4 Commercial Use

"22) The Division will encourage an environment that promotes the growth of the tourist industry...."

3.1.5 Protection of Private Property

"4) The Government, through the Division, will assist in preventing or controlling wildlife from damaging property and endangering human life.

"5) Responsibility for damage in any form caused by wildlife will be shared in relationship to what people can reasonably do for themselves and to the amount of any additional damage beyond that which would normally be

expected to occur in an area."

3.2 Management Goals And Objectives

3.2.1 Resource Protection

Goal: To ensure that the cougar population is protected from any significant decline and that viable self-sustaining populations are maintained.

Objectives:

a) Maintain a viable population of at least 600 cougars on provincial lands in Alberta. In southern Alberta, south of the Bow River, a population of at least 380 cougars should be sustained.

b) Allow a maximum man-caused mortality rate of not more than 15 percent on all cougar populations. Protect cougar in wilderness areas and other special areas; keep man-caused mortalities to a minimum in these areas.

3.2.2 Resource Allocation

Goal: To maximize the benefits to Albertans through optimum allocation of the cougar resource amongst recreational, commercial and other users.

Objectives:

a) Provide Albertans and visitors to Alberta the opportunity to view, photograph and otherwise enjoy the cougar resource.

b) Provide the opportunity for recreational hunters to annually harvest a portion of the provincial cougar population.

3.2.3 Recreational Use

Goal: To maximize the recreational benefits and enjoyment to Albertans from the cougar resource through the provision of a variety of recreational opportunities.

Objectives:

a) Promote recreational nonconsumptive uses such as observation and photography of cougar.

b) Provide opportunities for recreational hunting of cougar and a sustainable annual provincial harvest. Maximum harvest will be 10 percent of the estimated population in any specified area.

3.2.4 Commercial Use

Goal: To provide a commercial benefit to Albertans from the cougar resource.

Objectives:

a) Provide opportunities for Albertans to benefit from the tourism value of cougars.

b) Allow the opportunity for non-resident hunters to hunt cougar.

3.2.5 Protection of Private Property

Goal: To minimize property damage and other hazards to humans caused by cougars.

Objectives:

a) Ensure that cougar predation on livestock and pets is reduced as much as possible by planned land management and agricultural development and by preventive livestock management.

b) Reduce economic loss as a result of cougar predation by continuing the Livestock Predator Compensation Program.

c) Reduce the occurrence of chronic cougar problems on private lands by capture and translocation of offending individuals.

3.2.6 Science and Education

Goal: To promote and encourage scientific and educational activity to enhance knowledge of cougars.

Objectives:

a) Continue management-oriented research of Alberta's cougar populations and cougar-prey interactions.

b) Educate Albertans about cougars and their value in Alberta's natural environment.

c) Promote the cougar as an integral part of our wildlife populations.

3.3 Management Strategies

3.3.1 Resource Protection

Survival of the cougar in Alberta depends on successful management of prey populations, especially deer, elk, moose and bighorn sheep. Fundamental to the management of ungulates are habitat inventory, protection and enhancement and these strategies are detailed in the respective species management plans. Although specific habitat strategies for cougar are not recommended at this time, these may become considerations for the future management of this species in Alberta.

3.3.2 Allocation

Because of the growing demand for viewing and other non-consumptive enjoyment of wildlife, certain cougar populations will be managed with this as the priority or only use. Cougars in national parks, Peter Lougheed Provincial Park and provincial wilderness areas are protected from hunting. Recreational hunting of cougars may be further restricted where nonconsumptive demands are high.

Annual licenced removal of the cougar resource will be allocated as follows: resident hunting, about 80 percent; non-resident hunting, about 10 percent; and other benefits, about 10 percent. The current (1990-1992) non-resident cougar hunting allocation (11/66 = 17%; 17 allocations @ 55% success = 11 cougar) will be reduced when resident demand increases.

3.3.3 Population Inventory

The status of the cougar should be acknowledged by active management efforts. Cougar population trends in the province should be evaluated. Track counts on permanent survey routes may provide a reliable measure of trends in population abundance and enable wildlife managers to estimate cougar populations. These surveys would be designed principally to monitor trends in the adult female cougar population, since that sex-age class is the easiest to detect (Van Dyke et al. 1986) and the most important for the maintenance of a resident cougar population. Keeping records of all tracks crossed and their probable sex-age class will document the presence of other cougars in local populations.

3.3.4 Recreation Management

3.3.4.1 Hunting Management

Cougar hunting, which provides a quality recreational experience, will be continued in Alberta. To disperse the harvest over a larger area, hunting will be encouraged in western Alberta north of the Bow River. Opportunities for both resident and non-resident hunters will be provided.

The three-month hunting season (approximately 1 December - 28 February), implemented in 1990 to provide greater recreational opportunity, will be maintained. Length of consumptive cougar hunting seasons in neighbouring jurisdictions are as follows: Montana, 2.5 months; Idaho, 4-7 months; British Columbia, 2.5-12 months.

Regional cougar populations will be protected from overharvest by a quota harvest system; that is, when the pre-determined harvest is reached, hunting terminates in that specific area. This takes the form of a total quota (male and female cougar combined) and a female subquota. In the short term [until population estimates or trends from other areas in the province are available or other information (e.g., increase in reported conflicts, complaints or natural mortalities) suggests increased cougar abundance], the total quota will be set at 10 percent of the estimated population in all units or groupings of units [Cougar Management Area (CMA), see Figure 9]. The female subquota will be one-half of the total quota. In addition, a maximum man-caused, allowable mortality quota of 15 percent will apply to all CMAs; that is, recreational hunting will terminate when man-caused mortalities reach 15 percent within a CMA.

Cougar populations will be estimated at the CMA level by the product of the density estimate determined for the Sheep River study area,

the estimated proportion of cougars inhabiting the CMA relative to the Sheep River study area, and the available cougar habitat in each CMA as determined from ecological land classification mapping (Table 14, Figure 9).

$$\text{Total population} = \frac{4.0 \text{ cougars}}{100 \text{ km}^2} \times K \times \frac{\text{area of available cougar habitat}}{100 \text{ km}^2}$$

where: K = the estimated proportion of cougars inhabiting the CMA relative to the Sheep River area, based on habitat type differences.

The number of licences issued will be unlimited for, at least, the short term. Cougar licence sales have never been high (maximum of 173 in 1979). Licences allow the licencee to hunt cougar in any CMA.

Hunters are required to register a dead cougar within about 48 hours (two business days) of the kill. When the female subquota or when the total quota for a CMA is reached, the hunting season is closed in that CMA. Closure will be announced by registered mail or by a toll-free telephone system. Closure of the hunting season in CMAs that have had their female subquotas filled is necessary at this time since some hunters appear unable to differentiate male and female cougars. This policy could be reviewed in the future. If educational materials were used for several years, as suggested below, and if results of future hunting seasons suggested that hunters were avoiding the harvest of females, consideration could be given to allowing male-only hunting to remain open after the female subquota was reached. However, the current level of knowledge of many cougar hunters does not warrant this approach at this time.

Table 14. Total man-caused mortality and harvest quotas allocated for Cougar Management Areas (CMAs) in Alberta.

CMA	WMUs included	Suitable habitat (km^2)	Density estimate ($c/100km^2$)	Population estimate	Hunting		Total man-caused	
					Total quota	Female subquota	Total quota	Female subquota
1	300,302 400	1 935	3.7	75	8	4	11	6
2	306,308 402	1 604	3.7	60	6	3	9	4
3	304,305	1 292	4.0	50	5	3	8	4
4	404,406	1 799	3.5	65	7	4	10	5
5	408,410	484	3.5	15	2	1	2	1
6	310,312	1 701	4.0	70	7	4	11	5
7	314,316 318,320 412,414 416,417 418	4 659	1.8	85	9	5	13	7
8	322,324 326,328 330,332 429	8 946	1.0	90	9	5	14	7
9	420,422 426,428 430,432 434	3 606	1.5	55	6	3	8	4
10	436,437 438,439 440,441 442,444 445,446	8 425	0.25	25	3	2	4	2
11	337,338 339,340 342,344 346,348 350,352 507,510	37 205	0.1	40	4	2	6	3
Total		71 656		630	66	36	96	48

Figure 9. Cougar Management Areas in Alberta.

The adoption of a quota system has particular advantages. By imposing a restriction on the allowable harvest, the season can be lengthened with no fear of overharvest, resulting in additional hunting opportunities. By not restricting the number of cougar licences sold, as occurs with a limited-entry draw, the recreational opportunities are not reduced. In fact, lengthening the season allows for increased recreational opportunities. The longer season in conjunction with the quota will result in a more predictable harvest from year to year. The incentive, created by the female subquota, to take males should lead to the maintenance of stable cougar populations in all areas of cougar range in Alberta. In addition, the closure of some areas of the province to cougar hunting, once their quotas have been reached, while other areas remain open will probably result in a harvest that is more evenly spread throughout CMAs open to cougar hunting.

The disadvantages of a quota system revolve around the increased work load, both in administering the hunt and in the field enforcing the changes to the regulations. A typical enforcement problem occurring with the quota system is that a cougar shot in a closed CMA can be registered in a CMA that is still open. Regulations may require cougar hunting guides and/or the cougar hunter to return to the kill site if an officer suspects an illegal kill [Montana currently has this regulation in effect]. Since the majority of cougar hunting guides appear to favour this system, the level of noncompliance should be low.

Resident hunters have been responsible for at least two-thirds of the provincial cougar harvest each year (see Section 2.3.3). Resident versus non-resident harvest should be monitored annually. Separate quotas,

or possibly resident-only hunting in some WMUs, may be instituted.

An education program will be undertaken to teach inexperienced hunters and hunting guides the physical differences between male and female cougars. The importance of protecting the breeding female component of the population will be emphasized.

Spotted kittens and females travelling with them are protected by current regulations. However, kittens lose their spots when they are about 6 months old. Hornocker and Koehler (1984) attempted to reintroduce three 6-7 month old orphans into the wild and only one survived, suggesting many orphaned kittens probably will not survive unless they are at least 8-9 months of age. In other jurisdictions, protection of kittens has been strengthened by the addition of a minimum weight requirement--kittens under 27 kg (60 lb) and females travelling with kittens under 27 kg are protected. This is not recommended for Alberta at this time, but could be implemented, if needed.

It is suspected that some cougar hunters do not purchase their cougar licence until notified by their guide that a cougar is treed (in Alberta, the cougar licence may be purchased before or at any time during the open season). Such "will call" cougar hunting, which necessitates a long period of harassment to the cougar, is reprehensible and unethical. Potential strategies to eliminate this behavior, but that require additional investigation, include the following:

1) control of licence sales by either a period of time (e.g., 48 hrs) from purchase before valid use, or termination of sales prior to the season.
2) a requirement that a licenced hunter be present during the chase, and

3) continued restriction of OHV use (see Section 2.3.6).

The settled portion of the Peace River Region (formerly Big Game Zone 2) was open to cougar hunting up to 1989-90. As was summarized in Section 2.0, our current knowledge of cougar distribution indicates that this region contains very few resident cougars. With the implementation of the quota system, there is the opportunity to increase the cougar harvest in the province without including any harvest from that area, which should be closed to cougar hunting at the present time. This will increase the likelihood that dispersing cougars will settle in the area as residents. If environmental conditions are suitable, the result could be additional occupied cougar range in the province.

Because harvest of female cougar will be carefully managed, proof of sex will be required. Successful hunters will be required to submit carcasses or skins to the Division for inspection and verification of sex. This will also assist in ensuring all cougar are taken during the open seasons. For the most effective management of cougar, all skulls should be measured and aged to determine the actual sex-age composition of the harvest. To accomplish this, all successful hunters will be required to submit the skull at the time their cougar is registered. This is another tool that wildlife managers can use to assess the cougar harvest and the opportunity should not be lost.

Over 70 cougars have been captured and tattooed (always in the left ear) during the Sheep River cougar project between 1982 and 1989. Many of these cougars were kittens which subsequently dispersed from the area and could be shot by hunters anywhere in Alberta or elsewhere. In many cases, the tattoo is the only mark indicating the cougar's history. Many are known-age individuals, and the measurement and aging of their skulls will

provide a baseline for the current aging system used in Alberta. These cougars are extremely valuable in terms of the information that they provide to the management of cougars in the province. The requirement to bring in the fresh hide from legal cougar kills will ensure that these cougars are identified when they are shot. In addition, radio-collars should be returned to the Fish and Wildlife Division for future use.

An educational pamphlet will be prepared for distribution to cougar hunting guides and cougar hunters. The pamphlet will cover methods to determine the sex of a cougar based on track size, and on physical characteristics once it is treed. An explanation should be included of the requirements that successful hunters should undertake to meet. Basic biological information such as the physical dimensions of different sex-age classes and the reproductive history of females should also be included.

3.3.4.2 Nonconsumptive Use Management

Cougars are very rarely observed in the wild because of their naturally low densities and their elusive behavior. It is unlikely that a program can be developed which would effectively enhance nonconsumptive cougar-viewing opportunities. Some jurisdictions provide a nonharvest ("pursuit") season subsequent to the normal hunting season. Typically these seasons are used primarily by cougar houndsmen for wildlife enjoyment and to provide further training for their dogs. Disadvantages of nonharvest seasons that include pursuit of cougar are increased administrative and enforcement responsibilities and additional harassment and possible mortality of cougar. Young kittens may be captured and killed by hounds, ungulate kills made by cougars may be abandoned, and, in the case of cougars residing in accessible areas, continued harassment may induce physiological

trauma (Roberson 1984). Nonharvest ("pursuit") seasons are not recommended for Alberta at the present time, but should nonconsumptive demand for cougar viewing increase, special regional seasons could be considered. Pursuit for nonhunting enjoyment and dog training can occur during the open hunting season.

3.3.5 Man-Caused Mortality Other Than Hunting

Man-caused mortality quotas in individual CMAs will not exceed 15 percent of the estimated population (Table 14). Female subquotas for total man-caused mortality will be set at half the total man-caused mortality quota. A "cougar management year" will begin with the end of the previous hunting season in individual CMAs. For example, CMA 1 has a total man-caused mortality quota of 11 cougars and a female subquota of six (Table 14). If man-caused mortality (before the hunting season) accounts for five cougars including three females, then in that cougar management year the total harvest quota should be lowered to six, while the female subquota is also reduced, down to three. A registration certificate will be completed by the Fish and Wildlife Division for each occurrence of a cougar mortality, regardless of the cause of death.

3.3.6 Protection of Private Property

The Division should continue to provide advice on damage prevention, and provide investigational and review expertise regarding compensation claims, so as to reduce the effect of cougar predation on livestock and pets.

3.3.6.1 Prevention of Cougar Predation on Livestock

The grazing of domestic livestock in cougar habitats creates the potential for conflict and may ultimately affect cougar populations. This potential must be recognized in the context of agricultural policies. The costs of predator damage prevention, control and compensation programs should be considered when the expansion of agriculture activities into forested areas is proposed.

Crown land areas with cougar-livestock depredation problems will be identified. The Division will initiate discussions with the appropriate land management agencies and grazing disposition holders regarding management strategies to minimize cougar-livestock conflicts. In addition to discussing improved husbandry techniques, such things as obligatory removal of carrion, as required by the Livestock Diseases Act (1971) will be stressed.

3.3.6.2 Control

Divisional policies on problem/nuisance cougar actions on private lands were outlined in "Problem Wildlife Management in Alberta," 1973 and 1979 editions (Gurba and Neave 1979) and to a lesser extent in Horstman and Gunson (1983). The General Wildlife Regulations 50/87 of the Wildlife Act (1984) provide the most recent legislation. Cougar are listed (Schedule 1) as "big game." Cougar may be hunted on public and private lands where there is an open season and under the authority of the appropriate recreational licence. Landowners with problems are advised to report damages or potential problems to the Fish and Wildlife Division.

Upon confirmation of kills, maulings or threats to livestock, pets or humans, the Division will attempt to control human access, then capture and either translocate (move) or kill the offending cougar. Offending

cougars are almost always moved, with the exception of individuals that have exhibited unusual aggression towards humans or that are very old and in poor condition.

On minimally supervised grazing leases in the Green Area (Public Lands General Classification Map - 1986), predator control is often expensive and time-consuming, and may or may not be carried out, depending on economic and logistical considerations. Damage caused by cougars will be documented, as far as is possible, by Fish and Wildlife Division personnel for compensation.

3.3.6.3 Compensation

The Government of Alberta will continue to compensate losses of livestock (food-producing domestic animals), attributable to cougars, through the existing Livestock Predator Compensation Program.

3.3.7 Control of Disease

The Division will monitor diseases and parasites of cougars, and should educate the public concerning these diseases.

3.3.7.1 Monitor Disease

The prevalence of trichinosis (Trichinella sp.) will be determined periodically. Carcasses collected from successful cougar hunters will be used for this purpose.

3.3.7.2 Education

The life histories and significance of cougar diseases should be described in a publication on wildlife diseases in Alberta.

3.3.8 Science and Education

3.3.8.1 Science

Population Estimates - Estimates of cougar numbers in western Alberta, north of the Bow River (see Table 14) are conservative to ensure excessive harvest does not occur. Cougar populations in northern habitats should be investigated to determine cougar densities and appropriate harvest rates. These investigations could take at least two forms. One alternative is intensive cougar track surveys conducted over one or two winter seasons. This technique would provide a ball-park estimate of the number of cougars in the areas surveyed relative to the Sheep River area. The most accurate and most expensive alternative would be a capture and marking program with or without radio telemetry. This method would provide an estimate of absolute density. The accuracy of the estimate would be directly dependent on the time spent determining the estimate. Three winters were required to estimate the cougar population in the Sheep River study area.

Cougar/Prey Relationships - These relationships are only partially understood in Alberta (see Section 2.2.7). In addition to the prey species killed in the Sheep River area, cougar prey studies in British Columbia and elsewhere have indicated that cougars are effective predators of bighorn sheep. Since ungulate management planning requires knowledge concerning the effects of cougar predation, the Division should investigate cougar/prey relationships preferably in a number of locales in the Province.

These investigations could take several forms. The least time-consuming would be the collection and analyses of cougar stomachs from cougars shot by hunters. This would be worthwhile only in areas where there are questions about the relative composition of cougar diets, such as north

of the Bow River. However, the number of cougars shot in these areas would necessitate a relatively long collection period to provide a meaningful sample. A second method could involve tracking unmarked cougars for extended periods. Both scats and kills could be documented. The field work would be demanding and labour intensive. However, larger sample sizes would be collected in a shorter time period and predation rates could be determined. Finally, the most expensive option would be to radio-collar cougars in an area and radio-track them intensively using helicopter support. This method would provide accurate predation rates on ungulates and would also allow a larger number of cougars to be monitored concurrently, reducing the time necessary to collect an adequate sample.

3.3.8.2 Education

Because the cougar in Alberta is poorly understood, an education program will be introduced. Distribution of educational materials that describe cougar and cougar signs will encourage public awareness and appreciation of the cougar. This might, for example, include another uncommon species, the grizzly bear. A video on "Cougars - their Biology and Management in Alberta" could be produced with existing footage and information from the Sheep River project.

By increasing the ability of outdoorsmen to identify cougar tracks and other cougar sign, and the sign of other large carnivores as well, the Division would increase public awareness of the occurrence of these large predators in the wilderness. Distribution of the pamphlet through Recreation and Parks, and Alberta Forest Service offices would guarantee a wide readership.

Although information regarding large carnivores is available, the

general public still appears largely uninformed concerning the roles of these carnivores in the natural world. Management efforts by the Division are often misunderstood because of this lack of awareness. Ultimately, wildlife itself will benefit from an increased understanding among the general public.

4.0 MANAGEMENT PLAN APPLICATION

4.1 Provincial Summary

The provincial cougar population, located primarily in the south-west foothills and mountains of Alberta, is small, numbering in the vicinity of 685 individuals. An estimated population of 630 inhabit provincial lands outside parks and reserves. However, based on an analysis of the hunting statistics collected since mandatory registration was implemented in 1971, and biological data collected during the Sheep River cougar project between 1982 and 1990, the provincial cougar population appears to be healthy.

An opportunity exists to increase recreational use of the cougar resource in the province, while at the same time provide additional protection from potential overhunting in local areas. The adoption of a total man-caused mortality quota harvest system allows for a longer cougar hunting season without endangering the population's viability. The adoption of a female subquota provides additional protection for female cougars and their dependent young. Province-wide harvests could increase, particularly in northern areas.

Education will be designed to increase the public awareness and appreciation of cougars and other large carnivores.

4.2 Regional Perspective

4.2.1 Eastern Slopes Region

CMAs 4, 5, and 9, and portions of 6, 7, 8, 10, and 11 are located in the Eastern Slopes Region (Table 14, Figure 9). This region contains the

majority of cougar habitat in Alberta. In the southern end of the region, where the Sheep River cougar project is being conducted, cougar densities are 4.0 cougars/100 km^2. North of the Bow River, cougar density estimates are lower, varying from 1.5 and 2.0 cougars/100 km^2 in CMA 7 to lows of 0.25 and 0.1 cougars/100 km^2 in CMAs 10 and 11 in the north. A few WMUs have been overharvested in some years, particularly west of Calgary. However, most WMUs within the Eastern Slopes Region are harvested very lightly or not at all. The institution of the quota system could redistribute hunting pressure from the Southern Region to areas in the Eastern Slopes Region which have not been hunted. Since the estimates of cougar density north of the Bow River are crude, particular efforts should be made to institute a track survey program in this latter area.

4.2.2 Southern Region

CMAs 1, 2 and 3 are located entirely in the Southern Region (Table 14, Figure 9). Although cougar habitat in this region is limited, it is the best habitat in the province. Cougar density estimates range from 4.0 cougars/100 km^2 in the foothills to 3.5 cougars/100 km^2 in the mountains along the Continental Divide. Cougar hunting pressure is high. Cougars are consistently taken from all WMUs open to hunting; some WMUs have probably been overharvested in some years. The quota system will even out the kill from year to year in heavily harvested WMUs. The increased season length will probably result in quotas being met in many CMAs in this region.

4.2.3 Central Region

Small portions of CMAs 6, 7, 8, and 11 are located in the Central Region (Table 14, Figure 9). In CMA 6, cougar densities are estimated to be

4.0 cougars/100 km^2. In CMAs 7 and 8, estimated densities decrease northward from 1.5 to 0.1 cougars/100 km^2. Cougar hunting pressure is high in CMA 6 and the southern portion of CMA 7. However, further north harvests are sporadic. If quotas are filled in the Southern Region, this region could receive an increase in hunting pressure since access is good.

4.2.4 Peace River Region

Small portions of CMAs 10 and 11 are located in the Peace River Region (Table 14, Figure 9). Cougar density estimates are very low (0.25 - 0.1 cougars/100 km^2), and harvest is negligible. Former Big Game Zone 2 will be closed to hunting, because of uncertainties regarding this population. Occasional sightings and depredation complaints are probably most often young, dispersing cougars.

4.2.5 Northeast Region

The north and east portion of CMA 11 falls in the Northeast Region (Table 14, Figure 9). As in the Peace River Region, cougar densities are probably very low (0.1 cougars/100 km^2) and harvest is again negligible. Occasional sightings and depredation complaints are, as in the northwest, probably young dispersing cougars, although persistent sightings occur in the Drayton Valley, Busby-Westlock and Stony Plain areas.

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